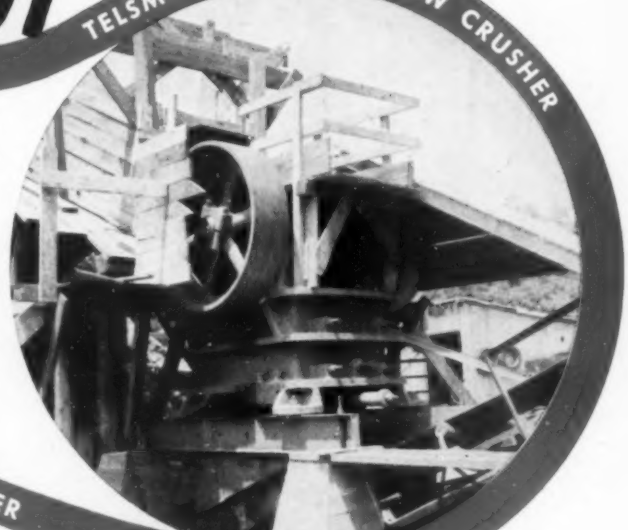
Rock Products

THE INDUSTRY'S RECOGNIZED AUTHORITY

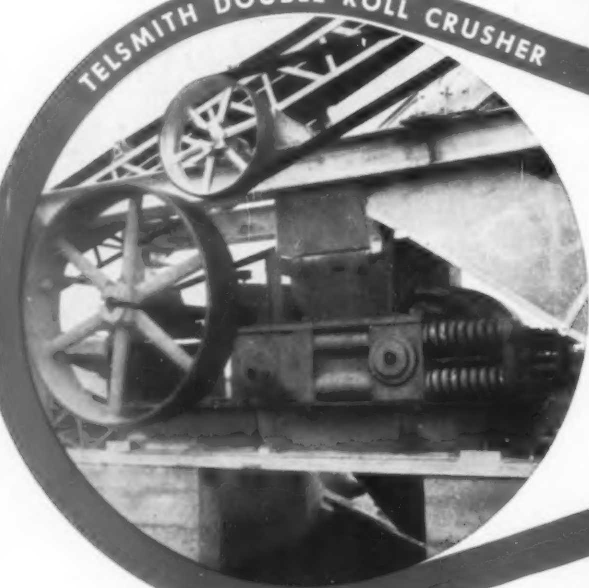
AUGUST, 1939

IN
O SECTIONS
CTION ONE

EXTRA OUTPUT

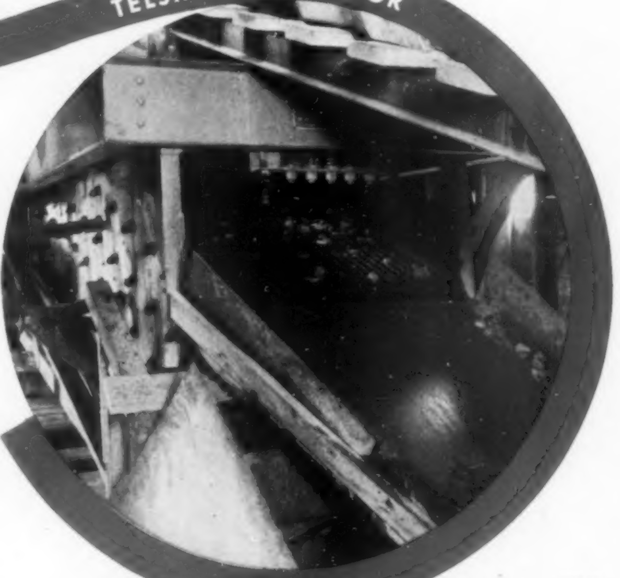


The most modern type of jaw crusher . . . for coarse or intermediate crushing . . . the Telsmith-Wheeling is equipped throughout with *cylindrical roller bearings.* This crusher delivers more crushing strokes per minute . . . almost double capacity . . . and greater reduction in one process than with any other type of breaker. All internal frictional wear is taken on the bearing races . . . no wear on shaft. Up-keep is reduced . . . service life prolonged. 7 sizes. *Write* for Bulletin W-11.



EXTRA PROFITS

For large output of fine aggregate at reduction ratios not over 3:1, use the Telsmith Double Roll Crusher. It produces less oversize than any other type of secondary crusher. Its compact design saves head room and weight. Anti-friction bearings (running in oil) and spring release insure high speed, continuous, trouble-free operation. First cost is low, too. *Write* for Bulletin L-11.



LOWER UP-KEEP

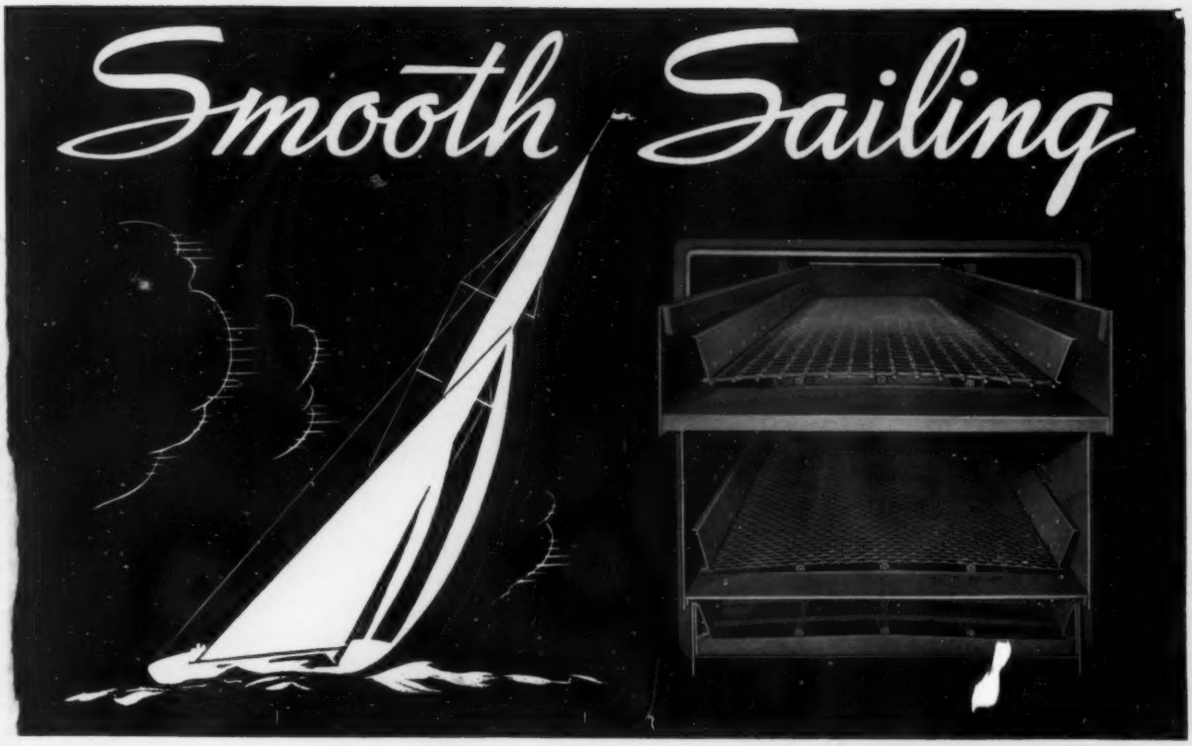
Sand, gravel, crushed rock, ore, coal—Telsmith Pulsator *screens 'em all,* wet or dry, and does it *right.* Its circular movement produces a maximum screening action that's *uniform* on every inch of the wire, regardless of load. Telsmith builds in greater value, longer life and lower up-keep with the toughest alloy steels, anti-friction bearings, and special seal protection for working parts. 11 sizes . . . 1, 2, 3 and 4 decks. *Write* for Bulletin V-11.

SMITH ENGINEERING WORKS
508 EAST CAPITOL DRIVE, MILWAUKEE, WISCONSIN
Cable Addresses: Sengworks, Milwaukee — Concrete, London
Associates in Canada: Canadian Vickers, Limited, Montreal

50 Church Street New York City	211 W. Wacker Drive Chicago, Ill.	713 Commercial Trust Building Philadelphia, Pa.
81 Binney Street Cambridge, Mass.	412 Westinghouse Bldg. Pittsburgh, Pa.	Brandeis M. & S. Co. Louisville, Ky.

MC-10

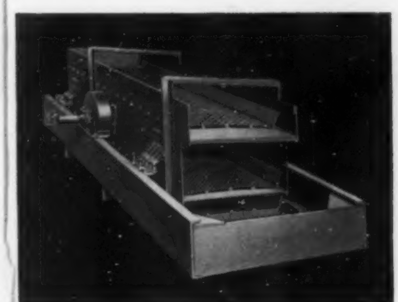
TELSMITH



. . . . . all decks cleared for action

THE CHANNEL IS CLEAR AND WIDE ON THE NEW PIONEER VIBRATOR SCREEN

With the new sagless screen mounting, there are no cross members on top of the screen to hinder the flow of material. The screen cloth is held tight at both sides of the screen and longitudinal members under the screen give it just enough crown so the material is spread to the full width of the screen.



Pioneer Heavy Duty Screen— Two, three or four decks . . . Heavy main frame with rubber bumpers and adjustable brackets for pitch adjustment.

Furthermore the Pioneer Screen has these features: It has a positive action using an eccentric shaft that insures the same results regardless of the load on the screen.

The screen is perfectly balanced — the pan is balanced end for end — and top against bottom — then the weight of the pan is counterbalanced in the flywheels. The result is a perfect balance and no vibration is transmitted to the supporting structure.

The bearings are SKF — the flywheels fully machined — and enclosed. The lubrication is Alemite.

Let us show you how a Pioneer screen will do your job faster — cheaper — and better.

PIONEER

PIONEER ENGINEERING WORKS · MINNEAPOLIS, MINNESOTA, U. S. A.

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NEXT MONTH'S ISSUE

The September issue of ROCK PRODUCTS will contain articles covering every important rock products industry. In addition to feature stories describing and illustrating new plants, this issue will have further installments of the very practical articles on Sand Classification, by Edmund Shaw; Simplification of Crushed Stone Specifications, by Elwood T. Nettleton; the Lime Forum, by Victor J. Azbe; and the Chemist Corner by well-known authorities.

Cost Accounting

Much attention is being given to the question of adequate accounting procedure in the crushed stone industry. An official of one of the most efficiently operated and managed crushed stone companies in the United States will describe in detail the cost accounting system of his company which will be illustrated with the various forms and reports which are used so effectively in keeping down costs and revealing information to the management which will serve as a guide in conducting the operating end of the business.

Clinker Cooling

One of the subjects of current interest to cement men is efficient cooling of cement clinker. This is an important factor influencing grindability and the quality of the finished product. With large buyers setting up specifications for cements that are more difficult to meet, a closer control of clinker cooling is demanded. The article in the September issue will give the answer to this problem as solved by a large eastern cement company.

Industrial Sand

Difficulties of operating a silica plant during all seasons of the year are sometimes thought to be almost insurmountable, but one company in the Middle West has changed its storage and reclaiming system and added drying equipment which has largely solved the problem. A description of these interesting changes will be published in the next issue.

Modern Gypsum Plant

Gypsum products are coming into increasing use in the building industry and for many industrial purposes, and a description of the newest plant for the manufacture of these products should be of interest not only to gypsum producers but to other rock products industries. Mass production methods and efficient handling of materials used at this new plant may be applied to advantage to every branch of processing.

Electric Eye

One of the large cement companies has been controlling the speed of its kilns through the use of the "electric eye". This unusual installation will be described and profusely illustrated with pictures, and it is expected that some interesting operating data also will be available.

ROCK PRODUCTS

RECOGNIZED THE WORLD OVER AS THE LEADER IN ITS FIELD

With which has been consolidated the journals *Cement and Engineering News* (founded 1896) and *Concrete Products* (established 1918)

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Impartial measurement of reader interest in terms of paid circulation.

Authentic facts relating to editorial scope and readership analysis.

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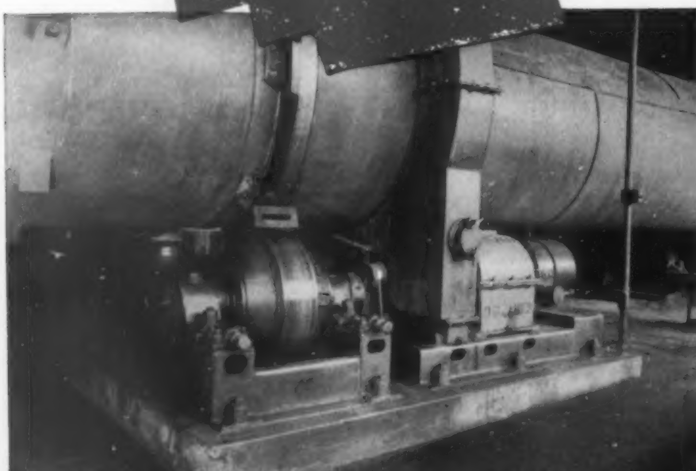
HOT SPOTS TO LUBRICATE



Trunion bearings operating at 200°F. on rotary kiln lubricated with Texaco Marfak.

Close-up of bull gear and ring driving mechanism. Texaco Crater Compound keeps gear teeth continually protected.

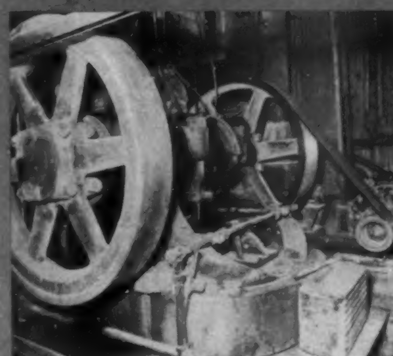
Crushed-Slate Processor Solves the Problem

WITH THEIR BIG ROTARY KILNS operating at 2200°F., their driving gears and trunion bearings continually exposed to temperatures of around 200°F., Minnesota Mining & Mfg. Co., at their Wausau, Wisc., plant, had a tough lubrication problem to handle. To meet this "red hot" situation, they turned to Texaco, specifying Texaco Crater Compound for the kiln bull gears, Texaco Marfak for the trunions.

For more than 2 years these lubricants have performed splendidly, withstanding these extreme bearing temperatures and pressures perfectly. During this period there have been no failures, no shut-downs due to lubrication.

Texaco engineers experienced in the selection and application of Texaco Lubricants for high temperature conditions gladly offer you their help. For this engineering service, or to place an order, phone the nearest of our 2229 warehouses, or write:

The Texas Company, 135 E. 42nd St., New York City, N. Y.



Jaw crusher operating from sub-zero temperatures to upwards of 90° F., Texaco lubricated.

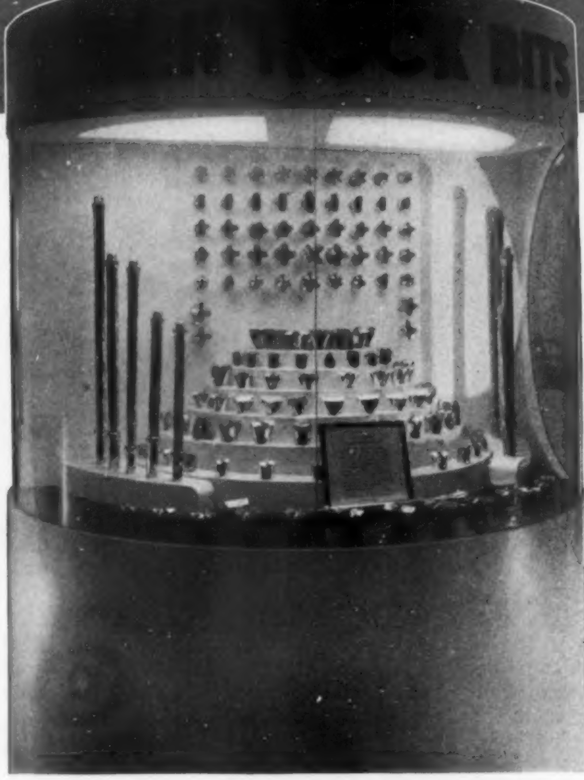
TEXACO

Crater Compound

The ideal lubricant for heavy-duty exposed gears and wire rope. Keeps gears quiet, longer-lasting. Gives wire rope added life, protects against corrosion.

TIMKEN

ROCK BITS AT THE NEW YORK WORLD'S FAIR



INTERESTING HIGHLIGHTS OF THE TIMKEN EXHIBIT

One of the first automobiles to be equipped with TIMKEN Bearings.

A TIMKEN Roll Neck Bearing having a load capacity of nearly three million pounds.

A machine that measures the thickness of a human hair in hundred-thousandths of an inch, as a demonstration of the precision with which TIMKEN Bearings are made.

A diorama showing in miniature the world's largest electric steel furnace—capacity 75 tons of steel per heat.

A TIMKEN Fuel Injection Pump cut away to show the internal mechanism in operation.

The various parts of a TIMKEN Bearing automatically assembling and disassembling to demonstrate the tapered design and construction of the TIMKEN Bearing.

A display dramatizing the Timken Roller Bearing Company's contributions to modern locomotive design—including TIMKEN Locomotive Bearings, main rods, side rods and other reciprocating parts.

And

THE TIMKEN ROLLER SKATERS in a sensational novelty act performed on a platform only nine feet in diameter elevated seven feet above the floor. The skaters perform ten times daily.

Also be sure to see the many Timken Bearing Equipped locomotives and cars in the Railway Track Exhibit.

Among the many valuable educational features of the Timken Exhibit is a wonderful display of TIMKEN Rock Bits. A portion of this is shown above. No one who has anything to do with the drilling of rock can afford to miss this splendid exposition of modern rock drilling methods.

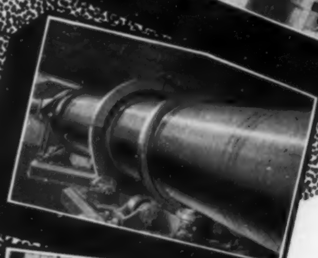
TIMKEN

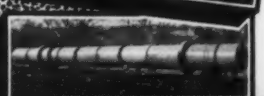
TRADE-MARK REG. U. S. PAT OFF

THE TIMKEN ROLLER BEARING COMPANY, CANTON, OHIO

TRAYLOR

CEMENT EQUIPMENT



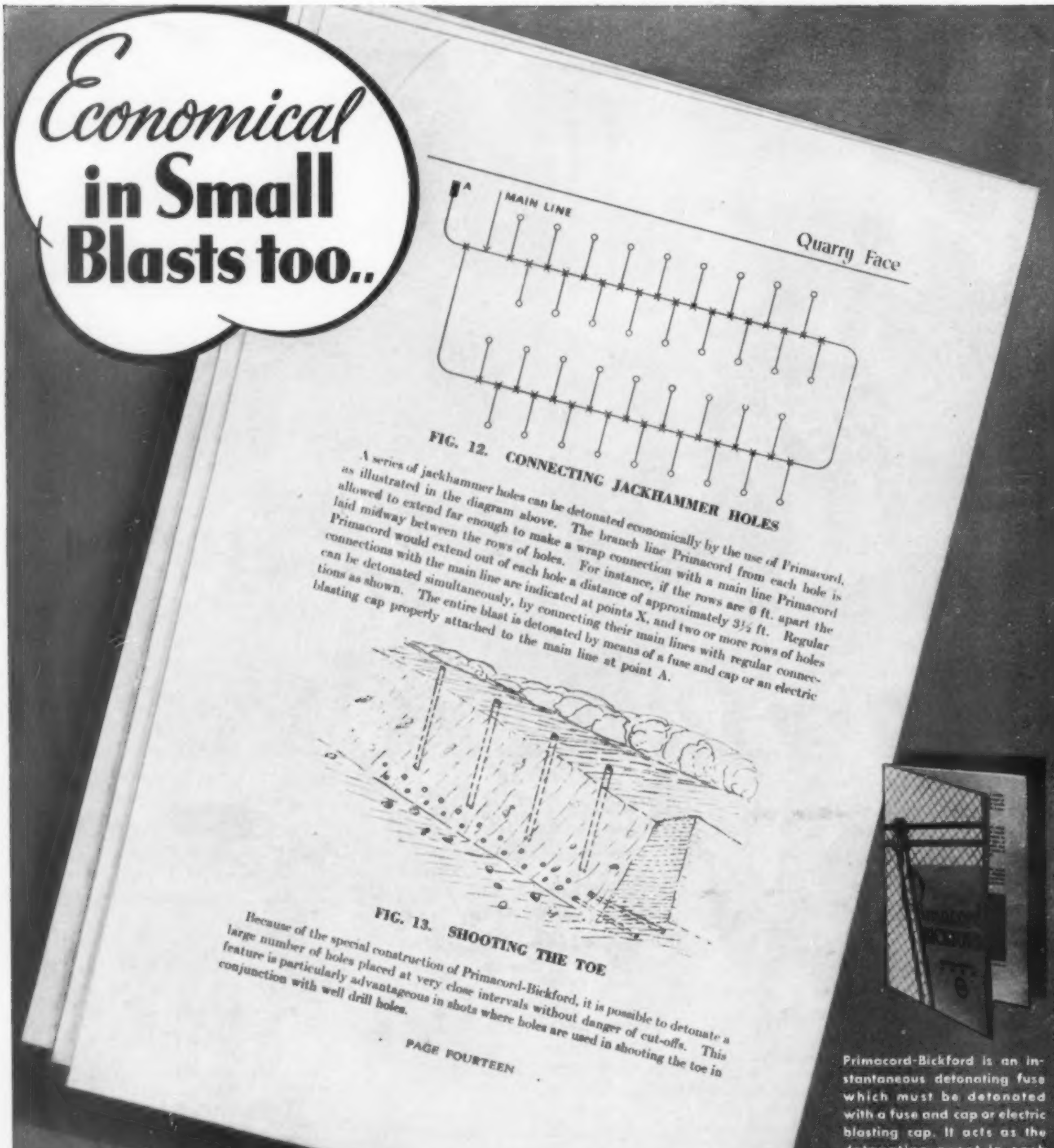


During a period of more than two decades, Traylor has won leadership in the manufacture of Rotary Kilns, Coolers, Dryers, Ball and Compartment Mills, for producing Portland cement, and for many other process industries. We have pioneered so many improvements in these units, to solve operators' problems almost as soon as they arose, that a Traylor has come to be known as "tomorrow's machine today."

In recent years we have developed a technique in electric welding, and created special handling equipment to do the work, that enables us to supply still better cement manufacturing machinery than the high quality which we have furnished heretofore.

Our facilities are for the sole use of our good customers, and all cement manufacturers and process industries are invited to use them to the full. Literature and consultation are available immediately, upon request. Write us today, about your problems and needs.

TRAYLOR ENGINEERING & MANUFACTURING CO.
ALLENTOWN, PENNA., U.S.A.

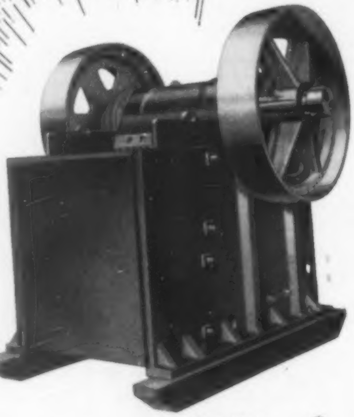


THE ENSIGN-BICKFORD CO., SIMSBURY, CONN., U. S. A. *Makers of Ensign-Bickford Safety Fuse since 1836*

PRIMACORD·BICKFORD *Detonating Fuse*

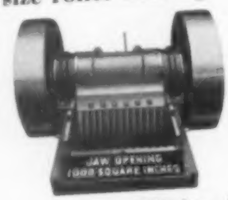
PB 11

Announcing 2 New Cedarapids CRUSHERS

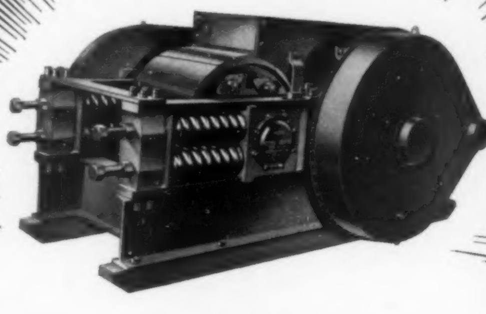


25" x 40" Roller Bearing JAW CRUSHER

A Big crusher for Big rocks — can be fed direct from shovel — reduces amount of intermediate breakage usually necessary with smaller crushers — narrow angle of nip assures rapid, continuous downward travel of rock in jaws — welded reinforced steel frame reduces weight and increases rigidity and strength — larger shafts and oversize roller bearings with special Cedar Rapids seals increases the life of the crusher and reduces the operating cost. A Primary Crusher that IS a money saver.

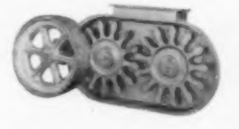


Write For Bulletin



40" x 24" Roller Bearing ROLL CRUSHER

A specially designed, extra heavy, secondary crusher for tough jobs — 24" width gives more capacity — segmental shells that are easy to replace — totally enclosed bearings requiring lubrication only once a year — oversize chrome molybdenum star gears — oversize springs — simplified adjustment — will crush all types of rock faster and more economically.



Write For Bulletin

IOWA MANUFACTURING COMPANY
CEDAR RAPIDS • IOWA

CEDAR RAPIDS

PORTABLE and STATIONARY
CRUSHING PLANTS • WASHING PLANTS
ASPHALT MIXING PLANTS
MATERIAL HANDLING EQUIPMENT

DON'T MISS THE September Issue

A New Angle on Clinker Cooling

Here is an article describing how a large eastern cement company maintains a closer control of clinker cooling in order to meet difficult specifications set up by large buyers of cement. This subject of efficient cooling of clinker is vitally interesting to cement men because this is an important factor influencing grindability and the quality of the finished product.

Do Your Cost Accounting Figures Tell the Right Story?

Are your hauling costs too high? Do you produce any unprofitable products? The way to answer these and many other cost accounting questions will be shown by an official of one of the most efficiently operated and managed crushed stone companies in the U. S. Also included will be samples of the various forms and reports which have been developed over a period of years and found to be very satisfactory.

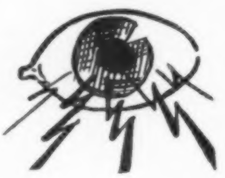
New Drying Equipment Increases Flexibility of Silica Plant

The addition of drying equipment and rearrangement of storage and reclaiming system enables a Middle West operator to run his plant during all seasons of the year. Here is the solution to many problems often thought to be insurmountable.

Mass Production of Gypsum Products

This new plant was the natural result of the ever increasing use of gypsum products in the building industry and for many industrial purposes. Other branches of the rock products industry can well take a lesson from the mass production methods and the efficient handling of materials employed here.

The Electric Eye in the Cement Industry



A prominent electrical engineer demonstrates another control device for the cement industry. One of the large cement companies is using the "electric eye" to control the speed of its kilns. Photographs and operating data will add materially to the helpfulness of the article.

YOU too Can Wash Your Stone with Less Cost

Just follow the example of this crushed stone producer who installed modern equipment. Now he produces cleaner product at a greatly reduced cost. Satisfied customers, repeat orders and increased profits soon will pay for the installation.

ALL THIS TOO!

Washing and Classifying Sand; Crushing, Sizing, Testing and Specifying Aggregates; Concrete Products; outstanding plant descriptions of interest to other branches of the rock products as well as all the regular departments.

Here's PROFIT for Advertisers

Every article in this issue is designed to be of the utmost usefulness to the industry with special emphasis on the installation of new equipment which has resulted in improved products, reduced costs and increased profits.

Are you making certain that our industry knows about the advantages of your equipment? The editorial contents of this issue provide a real selling background for your advertising message. Forms close August 21.

Another Issue with 100% Reader Interest

ROCK PRODUCTS for September


From 1909 to 1939
SHIPMENTS HAVE ALREADY BEEN MADE TO 14 QUARRIES IN THE FOLLOWING STATES:
UNITS PER QUARRY
UNITS PER YEAR
1936 NORTH CAROLINA 3 3
1937 FRANCE (Export) 3
PENNSYLVANIA 3 6
1938 NORTH CAROLINA 3
ILLINOIS 5
NEW YORK 6
TEXAS 2 16
1939 NEW YORK 2
NEW YORK 6
NEW YORK 10
NEW YORK 5
SOUTH CAROLINA 3
NORTH CAROLINA 3
IOWA 3 32
Figures for first 6 months 1939
EASTON 10 to 12 to
CAPACITY
PHOENIX
SEMI-TRAILER
(PATENTED)
TON CAR & CONST. CO.
Glendon St. Easton, Pa.
THE "PIQUA"
All Steel Quarry Trucks
Are always close to the ledge, and do away with expensive systems of tracks, and the cost of moving them.
STRONG—DURABLE
Quarrymen will do well to investigate this new means of reducing cost.
Equally adapted for hand or steam shovel loading.
SEND FOR CATALOG.
THE AMERICAN QUARRY TRUCK CO.
Box 516, PIQUA, OHIO.
1909
At the left is a reproduction of an advertisement which appeared in this paper thirty years ago. It illustrated the latest ultra-modern development in quarry transportation of the times. Comparison with today's latest equipment shown above in the reproduction of a current advertisement reveals the expansion of this industry.
EASTON CAR AND CONSTRUCTION CO.
GLENDON ST. • EASTON, PA.
Branches in New York • Philadelphia
Pittsburgh • Cleveland

IN APPRECIATION OF PORTLAND CEMENT

THE first manufactured building material was probably sun-baked brick. The mortar used to lay them up was most likely mud. At some period too ancient to be recorded builders discovered that burned limestone made a superior cementing material. And then began the evolution which has given us portland cement.

Volumes have been written about the romance of gold and man's search for gold in the farthest corners of the earth. Limestone is common and its literature prosaic, but the possibilities of romancing about limestone have always seemed to us far greater than the possibilities of romancing about gold. It would be a story not of blood and murder and chicanery, but of man's progress in the arts of building and of living—of his rise from caves and mud-covered reed huts to marble palaces and comfortable homes.

As commonly written, history would lead us to believe that the first colonists who left Europe and Great Britain in the fifteenth and sixteenth centuries for the "new world" spent a large part of their energies and enterprise in search of gold. As a matter of fact their first efforts were almost invariably in search of limestones. For until they found a satisfactory mortar material their dwellings and even their fire-places and chimneys were made of logs with the chinks filled with mud. No permanent structures were possible without cement.

The early English colonists, who came to New England and Virginia, knew that oyster shells were of the same material as limestone, and until they were able to find limestone deposits they burned shells for lime. But for reasons best known to them, they never could make a satisfactory building lime from oyster shells, and when limestone was discovered in Rhode Island, in the last decade of the seventeenth century, the use of shell lime for building was prohibited by law.

The Romans, and possibly their Egyptian or Greek predecessors, had discovered that the addition of pozzolanic or argillaceous minerals to lime improved its properties as a cement; and although the Romans carefully recorded this fact and the formulas for making their cements, mortar and even concrete, the world after the fall of the Roman empire remained long in ignorance of the art of cement manufacture.

In our own country the engineers who built the Erie canal locks were seeking an hydraulic lime when the superior qualities of natural cement were discovered. The story is that an investigator finding an apparently hydraulic lime which would not hydrate pulverized a small quantity to find out if that would help the hydration, and thereby started the famous natural cement industry of New York state.

From that small beginning of mortar cement manufacture has grown an industry which makes possible the actual "pouring" of great monolithic engineering and architectural structures with "liquid stone." Few laymen appreciate what that really means, but we have only to contemplate a Boulder or a Coulee dam constructed of stone masonry laid in mortar—perhaps a 50 or 100-year job—to see that without cheap cement and concrete we would not have advanced in the art of heavy structural engineering much beyond the period of the pyramids.

Add to this the romance in connection with the blasting away of mountains of limestone, and their pulverization to dust, the burning of the dust in huge kilns at temperatures our ancestors never dreamed possible, the pulverization of the "clinker" to dust again, the shipment in bulk of vast quantities of this dust and its incorporation with plain water into a liquid that can be moulded into artificial stone. What a theme for a writer of romance!

However, there isn't much romance in it for the men engaged in the manufacture and marketing of portland cement for they sell it at prices that astonish any one who is able to comprehend the multitude of heat and power units consumed, not to mention that there is also an investment and a labor cost involved. And a large part of the output has to be sold to remarkably unappreciative "public servants." Would we had the pen to extoll the lowly cement manufacturer not merely as a servant of the public but as a benefactor of mankind! Perhaps some day a more talented and romantically inclined writer will do the job we have in mind.

When that job is done, if it is done sympathetically and understandingly, we believe that much of current criticism of portland cement and cement manufacturers will be found to have been caused by their willingness to let college professors and theorists tell them that their cements had to be made to be subjected to a multitude of tests, which may or may not have some bearing on the slogan cement manufacturers themselves set up: "Concrete for Permanence."

Nathan C. Rockwood

Masonry Mortar Offers A New Outlet for Lime Plants

Kaolin is heated in a rotary kiln and pulverized, after which it is mixed with magnesium lime hydrate, white portland cement, and calcined gypsum. The resulting mixture is then tube-milled.

By BROR NORDBERG

LIME manufacturers are showing increased interest in by-products and other prepared materials that use lime as the principal ingredient. With the former markets for quick limes and hydrates decreasing, dry ice, aged lime putty, and various prepared mixes are looked to as natural outlets to build up production.

In recent years several plants have installed equipment to make masonry mortar mixes under patents of the Cement Process Corporation and the products have found widespread acceptance by the brick mason contractors.

Activated kaolin is pulverized in Raymond 5-roll, high side mill to 82 percent minus 200 mesh

One of the most interesting of these plants is that which is operated by Ladd Lime and Stone Co., Cartersville, Ga., where a process somewhat different than the conventional is used to achieve the same end result—a water-repellent mortar with adequate strength and a high degree of plasticity.

The product, "Ladco Bondo Masonry Product," has been on the market since December, 1937, its desirability for use by the brick mason being evidenced by the growth in volume of sales. Each month has seen an increase in sales. Distribution is usually in full carload lots and the new product has equalled the standard magnesium hydrate in volume of sales.

"Ladco Bondo" has an unusual whiteness, tests conducted by laboratory technicians showing that it possesses all the properties for a masons mortar mix. Whiteness is considered an important quality by the manufacturer, and the selection of materials and details of operation are governed to maintain this quality. Ingredients in the mix are Ladco magnesium lime hydrate, white standard portland cement that can be purchased within reasonable shipping range, calcined gypsum stucco and a rather unusual kaolin found locally. No waterproofing compound whatsoever is used. The kaolin contains 60 to 75 percent SiO_2 and 20 to 27 percent alumina and is the source of siliceous material. It has the appearance of a white, marly chalk and readily breaks down when exposed to the sun. The fortunate occurrence of this material does much to preserve the whiteness in the final product, and, judging from its appearance, very likely assists the magnesium hydrate in producing high plasticity.

Six years' experimentation preceded the production of "Ladco Bondo" on a commercial scale, during which time several methods of operation were tried and ruled out in favor of the present plant layout. The activation is done by heating in a rotary kiln and pulverizing this material separately to desired fineness after which it is mixed in desired proportions with the other materials and tube-milled.

Firing end of kiln in which kaolin is heated to activate silica before pulverization and mixing with other materials. Note pipe for collecting dust at point of discharge

Manufacturing Procedure

Gypsum (about 2 percent of the mix) and a light-colored portland cement (in bags) are shipped by rail and placed in steel bins. The kaolin property is leased and the clay is trucked in lumps to the plant, on a contract basis, where covered storage is provided for 2000 tons. Average moisture is 12 to 15 percent when reclaimed to be fed into the kiln. A kaolin roll-type crusher is being installed to reduce it to minus 3-in., with the crushed product elevated by a chain bucket elevator to discharge into a 6- x 60-ft. rotary kiln.

The kiln turns at 2½ r.p.m. and is fired by natural gas through a Denver Fire Clay Co. burner. The kaolin is calcined at the rate of four tons per hour. Upon discharge into an inclined drag conveyor, a slight amount of water is added, which

further accentuates the whiteness and adds slightly to the strength of the final product. The drag discharges on a concrete floor which has ample capacity to keep dried material well ahead of pulverizing operations. Dust is collected in a conical collector and blended into the stocked material.

From stock, the activated silica is fed into a Raymond 5-roll, high-side mill and pulverized to 82 percent minus 200-mesh, somewhat coarser than the portland cement, in order to have a comparable reduction when the final mix is put through the tube mill. Ground silica is stored in a 150-ton overhead bin. Next in actual quantity used is the dolomite magnesium hydrate, which has a fineness of 94 percent minus 200-mesh. To control setting of the mortar, calcined gypsum stucco is 90 percent through 200-mesh, and the cement is 92 to 94 percent through the 200-mesh.

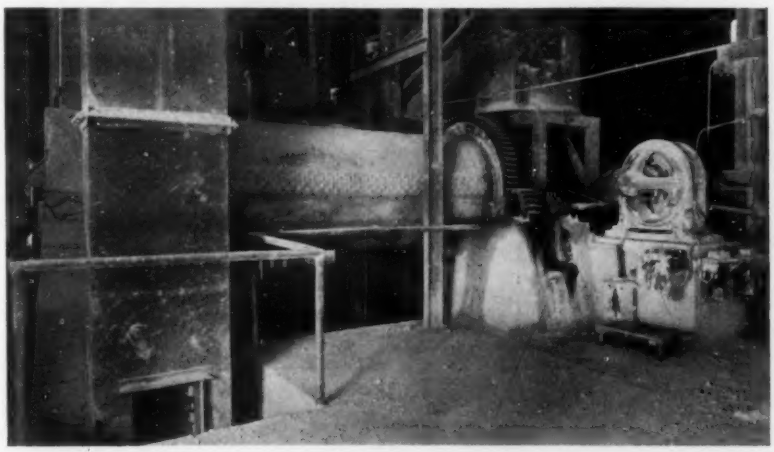
Grinding During Night Reduces Power Demand

Desired quantities of each of the four materials are fed out by star feeders into a common screw conveyor, then to a bucket elevator and into a tube mill feed tank, where a similar feeder puts the mix into a 4- x 18-ft. tube mill. The tube mill, turning at 28 r.p.m., is lined with Silex to keep the product white and graded steel balls are used in grinding. Each of the two tube mills has a capacity of 3 to 4 tons per hour, ground to about 93 percent minus 325 mesh, with a specific surface of about 2800 sq. cm. per gram.

From the tube mills, the product is elevated into steel storage bins of 300-ton capacity, to be reclaimed by screw conveyor and elevator into a packing machine bin. A 2-spout Bates packer fills 60 lb. of Bondo (1 cu. ft.) into double-walled paper bags. The

Exterior view of plant which is now devoting a substantial part of its production to the manufacture of masonry mortar mixes. Crushed stone is also produced

Loading selected stone in the quarry into Lambert skips for transportation



One of the two 4- x 18-ft. tube mills through which gypsum, lime hydrate, portland cement and activated silica are pulverized simultaneously in definite proportions

Below: Personnel and officers of the Ladd-Lime & Stone Co.

entire plant layout for manufacturing "Ladco Bondo" has 280-h.p. in connected electric motors, but grinding is done at night to hold down power demand.

Laboratory tests show an average surface area of 2850 sq. cm. per gram, or a fineness of 92.83 percent minus 325-mesh with a specific gravity of 2.59. On strength tests of "Ladco Bondo" mortar by a well known commercial testing laboratory, specimens showed compressive strengths of 1117 p.s.i. and 1654 p.s.i. at 7 days and 28 days respectively.

The mortar product passes Federal and A.S.T.M. standards for non-staining qualities, setting time, water retention and repellency. Another interesting test has been run, using one sack of Bondo (60 lb.) and one sack of portland cement (94 lb.) with 2.73 parts of fine Ottawa sand. Specimens mixed with water in the above proportions according to A.S.T.M. standards, show compressive strength of 2052, 2678 and 3864 p.s.i. at 3, 7 and 28 days respectively.

In December, 1937, a sample of the prepared mix was submitted to a testing laboratory to be used in building brick piers to test the actual mortar strength when used in brick work. The brick selected were 80 percent common shale brick with an average compressive strength of 815 p.s.i. and an average modulus of rupture of 1387 lb. The piers were 8- x 12- x 24-in., using 24 brick in each pier with a ½-in. mortar joint between each brick.

Two piers were made, one for a 7-day and one for a 28-day test, each being cured in a moist room at 70 deg. F. The mortar consisted of one part "Bondo" to three parts Ottawa sand with water added to give a mortar flow of 130—comparable to the consistency on any brick job. On compression, the 7-day and 28-day test piers were subjected to 145,200 lb. and 212,600 lb. respectively, or 1512 p.s.i. and 2214 p.s.i. At the same time 2- x 2- x 2-in. mortar cubes were put under test, showing an average of 1146 p.s.i. and 1862 p.s.i., respectively, at 7 and 28 days. The comparative figures for mortar cubes and the piers indicated that the strength of the mortar in the piers is greater than that which was tested in cubes due to the stiffening action of the brick. When tested to failure the pier fractured and broke the entire brick in half when the mortar crumbled.

Col. W. H. McNaughton, president, and Raymond Hoagland, vice-president, and treasurer, are in charge of all activities of the Ladd Lime and Stone Co.

Leaky Masonry Wall Problem

By K. P. FERRELL*

UNQUESTIONABLY, present construction, materials and design are producing a much higher percentage of wet walls than formerly. At least this is sadly true through this particular section of the United States and I understand elsewhere as well. Perhaps the statement should properly be made that more walls of buildings are showing dampness on the inside, as undoubtedly all masonry walls have and do leak more or less, but of course owing to design or other reasons, dampness does not always show on the interior. Authorities quite agree on reasons that *might* be the cause but apparently are not accord as to the really vital changes that should be made to relieve the situation.

Comparative workmanship, harder units, higher strength mortar, thicker joints, thinner walls, taller buildings, non-load-bearing walls, special units for back-up, rather than solid brick walls, lack of furring, and other differences have been pointed out as contributing to leaky walls. The speed in the erection of buildings and a demand for better weathering of joints has forced the use of stronger mortars. Harder units have been demanded by architects and users for strength, weathering and density. No doubt all of these are factors of some import, but to what extent?

In the case of portland cement concrete, the higher the strength and cement content, the greater is the shrinkage factor. From that fact undoubtedly most everyone takes the idea that the same is true of mortars for unit masonry. I submit from tests we have made and base on other facts that the high-strength mortar does not necessarily have the greater shrinkage, either initial or total.

Plasticity Important

The matter of plasticity enters the mortar field to a far greater extent than in connection with concrete. Various mason cements, various cement-lime and lime-cement mixtures have quite different plasticity values and because of other characteristics than the amount of lime or cement or admixture. For instance, the plasticity value of limes, even limes of the same classification, magnesian or calcium, is not the same, nor is their shrinkage a factor. That they have quite different water requirements seems to be the important yardstick. In other words, it is possible to make a mason cement or a cement and lime mixture of high strength and yet of comparatively low shrinkage. This being true, then high-strength mortars, as a class, cannot be blamed for wet walls because of a mistaken conclusion such mortars have more shrinkage.

Authorities Disagree

Professor Walter C. Voss in "Why Masonry Walls Leak" speaks often of a high lime mortar and strongly recommends the use of such mortar. Yet, when asked what mortar to use for repointing and repairing a leaky job, he recommends a 1-1-4 mixture and recommends the same mortar for use with granite, as it is a hard natural stone and usually non-absorptive.

And so on "far into the night." Now, turning from discussions of leaky masonry and to technical papers and investigations in connection with concrete, we find considerable space devoted to curing. Concrete and mortar of course have much in common, so it would be natural that any subject in which one was vitally concerned should be one to draw the attention of the other.

Proper curing of concrete is recognized universally to be a very important part of producing satisfactory and quality concrete. A concrete specification without requirements for a curing period is just not a complete specification and many devote more space to this matter than to most any other. Yet, in connection with mortar for unit masonry, I fail to find any literature or investigation dealing primarily or even at length on this subject.

Providing plenty of moisture to concrete during the early hardening period or at least insuring little or no less of the mixing water used, has definitely proved to be beneficial and necessary to every desirable quality of the finished product. Impermeability, strength, durability, etc., are all aided by proper curing. Without question the same must be true of a mortar in unit masonry.

From my observation a large part of mortar troubles is caused by too rapid loss of moisture by the freshly placed mortar. When this happens high initial shrinkage or packing takes place and adhesion to the unit is seriously interfered with in addition to the fact that a soft or chalky mortar joint is more porous.

*From a letter to the Editor. The author is technical service manager, Dewey Portland Cement Co., Davenport, Ia.

In the center background is the sand separation plant where five sand sizes are produced over the sand storage compartments. Three long boom conveyors in foreground place gravel from track hopper into ground storage stock piles

Change Grading Methods

Underground reclaiming tunnel facilitates blending five sand sizes and three gravel sizes. Sand plant placed over storage compartments.

By FRANK M. WELCH*

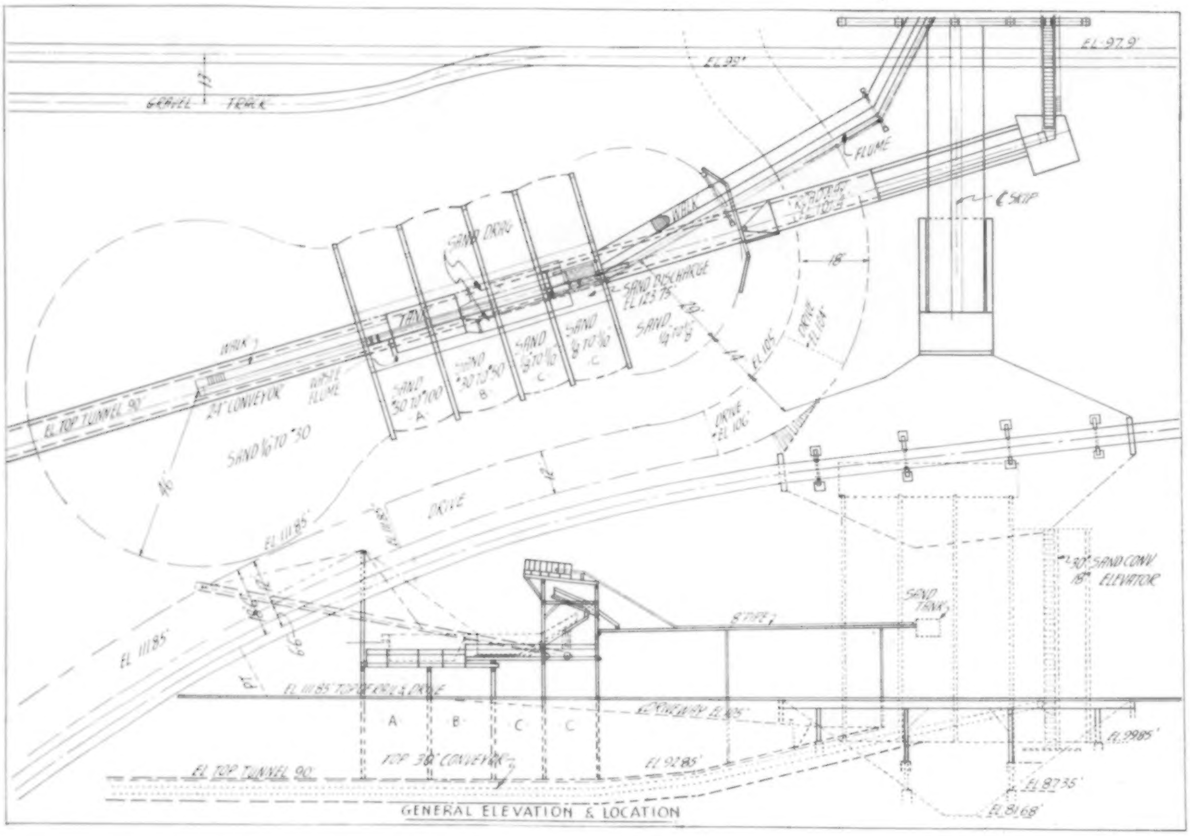
METHODS of refining and grading sands have been changed completely at the South plant of the American Aggregates Corp., in Columbus, Ohio, and storage and reclaiming facilities have been increased. This large, modern and efficient unit of steel located within the city limits of Ohio's capital has produced a large tonnage of washed sand and washed, crushed and screened gravel during the 12 years it has been operating. From time to time changes have been made in keeping with market requirements and improved methods, but the additions completed during the past winter and spring represent the application of entirely new methods.

During the past two years, extensive ground storage has been maintained for several grades of sand, gravel and crushed products. Large stock piles of finished products ready for quick delivery were accumulated as an experiment in this territory, and the storing as well as the reclaiming facilities were somewhat temporary. Finished products from the plant in excess of immediate demands were loaded into railroad cars and switched to the storage area, where they were unloaded by a yard crane into piles surrounding a field hopper. The same crane reclaimed the materials as they were needed by depositing them into the field hopper from which a belt conveyor returned the aggregates to bins in the top of the main plant for loading into cars or trucks or to the batch mixing plant.

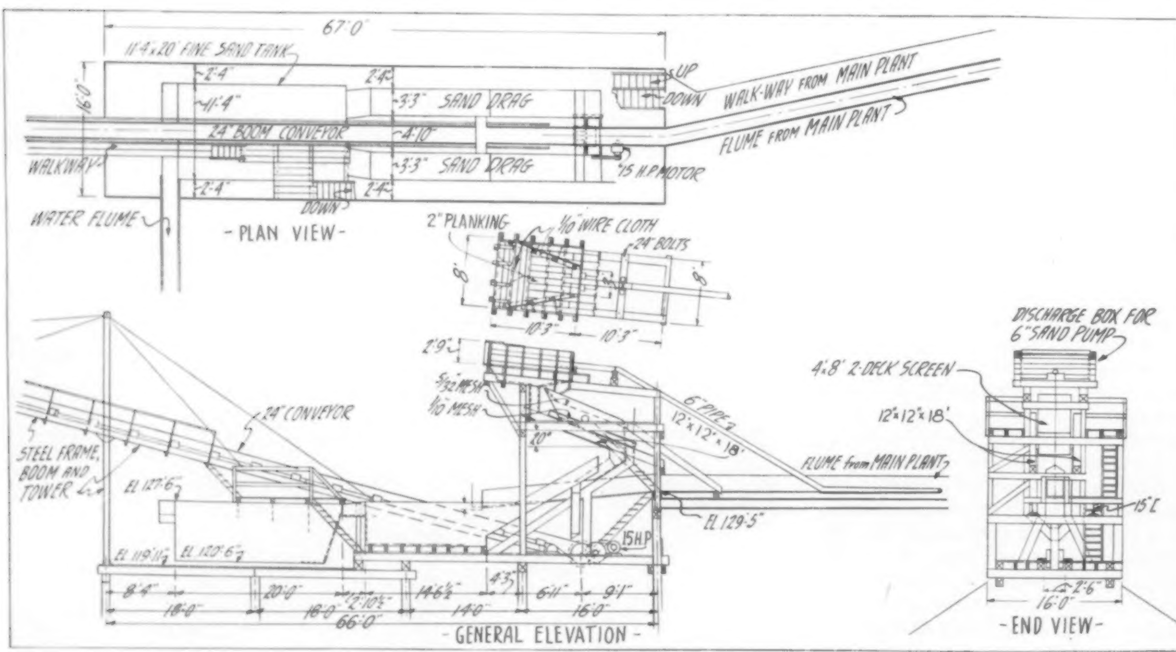
In this same period, the company in its other plants in Ohio, Indiana and Michigan had been developing and perfecting methods of grading and storing sand in two, three or four different separations. These changes had been brought about by federal and state specifications which more and more were demanding that sand be split on one mesh or another. Perhaps the climax of these developments was reached in the design and operation of the company's floating gravel plant which furnished the aggregates for the Guntersville, Ala., dam for the Ten-

Another view of storage conveyors for three grades of gravel. Boot of conveyors under track at right permits direct unloading

*Manager, F. M. Welch Engineering Service, Inc., Greenville, Ohio.



Elevation and location plan showing the method of producing and storing five grades of sand with tunnel conveyor below storage compartments for reclaiming and blending purposes



Plan view of sand separation unit, above, indicating relative location of flume, screen, two sand drags, boom conveyor, and sand settling tank, and below, elevation views of plant

nessee Valley Authority described in Rock Products, June, 1937, pp. 54-59.

Ground storage facilities in the new addition to the Columbus plant are over 500 ft. long. About half of this is for sand storage with bulkheads dividing the sand into five different grades. These bulkheads serve as supports or substructure for the sand grading and classifying plant. The other half stores three sizes of gravel also separated by bulkheads.

Tunnel Conveyor for Blending

Underneath the entire storage area are 30-in. belt conveyors operating in concrete tunnels, an arrangement which permits reclaiming any size of sand or gravel or any blending of sizes. The reclaimed aggregates are conveyed to a 14- x 27-in. steel roller chain super-capacity bucket elevator which is high enough to discharge into several bins or to the batching unit in the main plant. At the head of this elevator is a 4- x 8-ft. single deck Simplicity vibrating washing screen which makes it possible to rewash or rinse any of the reclaimed material.

Methods of handling the sand represent the major change in the flow sheet of the Columbus plant. Prior to these changes all sand for shipment either by rail, truck or to batch mixers was prepared in the main plant, but now all sand is pumped by an 8-in. Amsco pump and flumed to the top of the new sand storage unit about 125 ft. away. Here it is discharged on to a double-deck Simplicity screen from which 3/16-in. to 1/8-in. sand is placed into the first storage compartment; 1/8-in. to 1/10-in. into the second; and 1/10-in. down into a flume leading to two 3- x 5- x 28-ft. sand drags.

The sand drags discharge 1/10-in. to 50-mesh material on to a 24-in. boom type conveyor, 110-ft. centers, which deposits this material into a large pile in the fifth compartment. Overflow from the sand drags goes

Steel roller chain elevator takes material from the head of the tunnel conveyor to the top of the main plant

to a 12- x 20-ft. sand settling tank which, on account of its length, separates the 50-mesh sand into two sizes and deposits them into the third and fourth compartments, respectively. With the sand from 3/16-in. down definitely separated into five different grades, it is possible in loading out to combine the sizes to meet any specification demanded.

Each of the fine sand storage compartments is divided into two parts by water tight partitions, which enable these sands that carry considerable water from the big settling tank, to be deposited on one side one day and on the other the next, to give them time to dewater. Dewatering or draining of these piles, as well as the other sand storage areas, is facilitated by fine mesh screens backed up by heavier mesh for strength, mounted on drainage flumes in the partitions and on steel pipes underneath the piles.

The flow sheet of the gravel was not changed in the main washing plant. It is still loaded directly from the bins underneath the screens. Any surplus grades produced from day to day are loaded into cars as they were previously, except that these cars are now switched to a siding which parallels the ground storage and tunnel system. The gravel storage is divided into three compartments also separated by bulkheads. Opposite the center of each gravel compartment a 10- x 10-ft. steel and concrete track hopper is installed under the gravel siding. From underneath each hopper a 24-in. boom conveyor, 100-ft. centers, transfers the three grades of gravel to their respective storage piles. The steel frames for these three boom conveyors, as well as the one on top of the sand storage plant, are of the tower and cable type of construction, and each is driven by a 15-hp. motor at the tail end.

Ground storage for several gradations of 100 percent crushed gravel is still maintained at the former location in the yard from which it is handled by Barber-Greene loaders and the yard crane. Near the discharge end of the new ground storage tunnel a dump hopper is provided leading to one of the tunnel gates. Through this hopper crushed material from the yard storage can be combined on the tunnel conveyor with any of the round gravel.

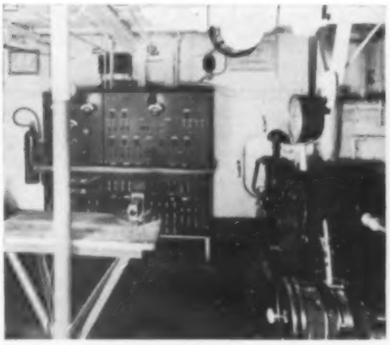
A large percentage of the building material and machinery for the new ground storage plant came from Columbus plant No. 2 located on Dublin road, which was recently dismantled. The four boom conveyors, sand drags, large steel roller chain super-capacity elevator, steel construction, chutes, spouts, undercut gates and other parts not on hand were furnished by the Greenville Mfg. Works, except the conveyor idlers which were supplied by the Chain Belt Co. Designing and engineering was done by the F. M. Welch Engineering Service in collaboration with officials of the American Aggregates Corporation.

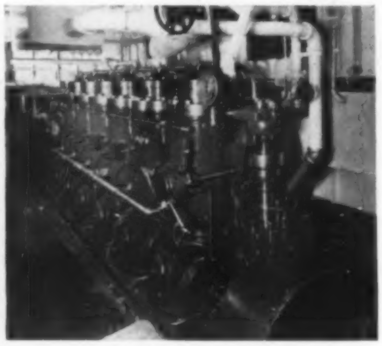
Left: Sand plant, showing screen, two sand drags, and boom deposit, 1/10-in. to 50-mesh to fifth compartment

Right: Bridge from main plant to sand separation unit carries pipe lines, flume, and walkway

Rock Products Men Go Nautical

To the old-timers in the rock products industry, the launching of the Edward W. Renwick, new Diesel-powered tow boat, brought back memories of the man for whom it is named, the late general superintendent of the Chicago Gravel Co. In fact, the Marine Transit Co., Chicago, Ill., is operated by men who have long been identified with the industry. President Charles C. West is a vice-president of the Medusa Portland Cement Co., Manitowoc, Wis.; vice-president, George Renwick is vice-president of the Chicago Gravel Co.; secretary-treasurer, A. C. Piske holds the same office with the Chicago Gravel Co., and John Reading is general manager.





Left: Twin Caterpillar Diesel auxiliary engines on tow boat, direct-connected to 20 kw. generators. Right: One of the two 300-hp. Kahlenberg Diesel engines to propel boat

The new boat will operate between Chicago and St. Louis in barge service. It is powered with two 300-hp. Kahlenberg, two-cycle Diesel engines, and also has two Caterpillar auxiliary Diesel engines, direct-connected to 20 kw. generators producing 100 volts d.-c. for operation of steering apparatus, hydraulic control for raising and lowering pilot house, refrigeration, and lighting system. When the pilot house is lowered, the overall clearance is 13 ft. 10 in. The boat is 100 ft. long with a 25-ft. beam and an 8-ft. moulded depth. She has a fuel oil capacity of 13,280 gal., lubricating oil tanks hold 600 gal., and there is a water supply of 3800 gal.

Hauling capacity is between 6000 and 7000 tons at 4 m.p.h. The six hopper-type barges and the tow boat are electrically welded throughout. Each barge is 158 ft. long, 26 ft. beam, and 10 ft. deep, carries 800 tons, and draws 8 ft. of water. Tow boat and barges, which cost approximately $230,000, were built entirely to American Bureau of Shipping specifications by the Manitowoc Engineering Works, Manitowoc, Wis.

It will be noticed that the bow of the tow boat has heavy steel "knees" which permit operation as a pusher as well as towing. The hull is also designed so that it may be used as an ice breaker.

Another Edition of "Portland Cement"

Announcement has been made that new copies of "Portland Cement" by Richard K. Meade, the well-known authority on portland cements, may now be obtained from the publisher. This is a new issue of the third edition published in 1926, but as a text and reference book it continues as a valuable source of information covering every phase of portland cement manufacture.

The contents are divided into an introduction which gives the history of the industry and the nature and composition of portland cement; manufacturing methods, and equipment from the quarry to the packhouse; analytical methods, physical testing of cement; and a concluding section which describes methods of detecting adulteration in portland cement and investigation of materials for manufacture of cement. The book which contains 707 pages and costs $10 per copy may be obtained from The Chemical Publishing Co., New York, N. Y.

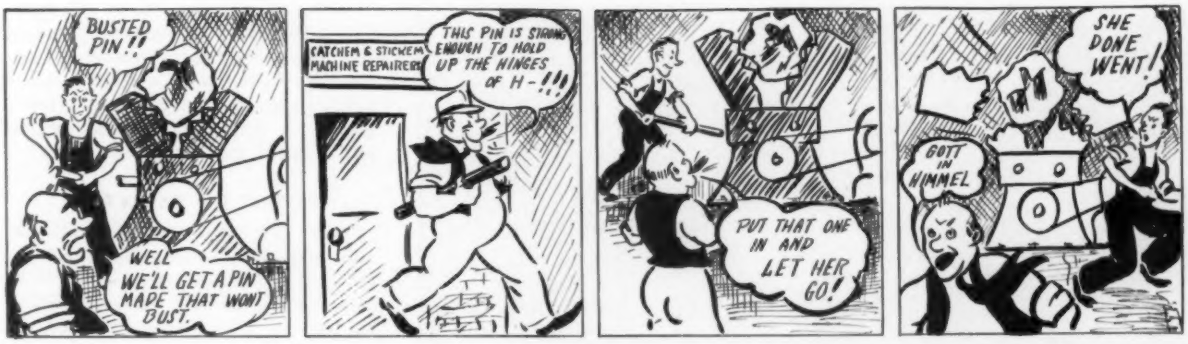
Engineering Terminology In Second Edition

Additions and revisions have been made in the second edition of "Engineering Terminology," by Brown and Runner, recently published, and several supplementary appendices have been added. The book defines the accepted meaning of a word or phrase as used in a particular branch of engineering.

The ground covered by engineering has long been too large for any individual to grasp. Every engineer, therefore, finds himself occasionally confronted by a term which is in his own or some other field but which conveys no exact meaning to his mind. This book gives him the answer.

Also included are appendices giving standard symbols, Spanish-English terms, English-Spanish terms, English-German terms, standard conversion units, abbreviations for scientific and engineering terms and conversion factors. The book is published by Gillette Publishing Co., 330 So. Wells St., Chicago, Ill.

The Edward W. Renwick, new Diesel-powered tow boat of the Marine Transit Co., has been named for the late general superintendent of the Chicago Gravel Co. Pilot house is raised and lowered hydraulically



Where to Buy Repair Parts?

Some helpful suggestions for the purchase of repair parts which assure low installation cost and maximum service.

By NATHAN C. ROCKWOOD

A CONTRACTOR, in order to save three or four dollars, had a replacement transmission case cover for a power shovel made locally, instead of buying one from the local stock of the shovel manufacturer. He took the original cover, which had cracked, to a foundry, and had it duplicated, as he thought, exactly. But the crack happened to go through a small oil hole; the foundry thought that the hole was merely a part of the crack, and so didn't duplicate it. Lack of oil, which would have been supplied through that hole, caused the transmission to freeze and wrecked the entire shovel.

As a result, the contractor fell behind on a time-penalty contract, and lost thousands of dollars. He engaged in an expensive lawsuit with the shovel manufacturer, which went clear to the Supreme Court. The manufacturer, of course, won. Today that contractor is back at pushing a wheelbarrow because he pinched a few pennies on the purchase of one little repair part. At least that is the story as I had it.

Take a simple thing like a bolt. Bolts that one manufacturer we know uses for certain purposes are made of a special analysis to take care of fatigue and rupture through stretching. One of this firm's customers thought he could purchase these bolts more cheaply elsewhere, and was able to do so, and did.

The plant superintendent subsequently was asked to please check the breakage and see if in a short time he did not have many more broken bolts, and thus a greater repair cost with these cheaper bolts than with the special bolts. It was only a short time later that he advised that his experiment was quite costly and that the special bolts even at higher first cost proved considerably cheaper in the end.

Crushers and grinding machinery are frequently made purposely with "a weak link," which will break and save wrecking the entire machine. I heard of an instance where one of my manufacturer friends used a shear pin, the idea being that if overloaded this pin would break and thus no damage would happen to certain other parts of the machine. However, when the pin broke through his having overloaded the machine, the superintendent had one made of much better quality, thus much stronger, which did not break at the next overload and did damage running into many hundreds of dollars to various parts of the machine. In other words, this pin acted the same as a fuse in an electric circuit. The user would have saved considerable money if he had continued to get these pins from the original manufacturer.

Very seldom do all parts of a machine become obsolete at the same time; any more than they all wear out at the same time. So in buying repair parts and replacements from the manufacturer of the original part, the purchaser very often gets an improved piece of equipment. Every machinery manufacturer watches the performance records of his product. He is close enough to many of his customers to get an intimate picture of maintenance and repair costs; as a result he is constantly redesigning to eliminate unnecessary expense by the user.

Improvements in Design

This redesign, or improvement in design, may take many forms and pass unnoticed by the average purchaser. The pattern may be changed, better and newer metals or alloys used, a better manufacturing technique employed in shaping the part. Machinery manufacturers are constantly studying new alloys and heat treatments to find ways of improving parts. Their service departments are constantly alert to find weaknesses in the machines that are out. Very frequently a user of machinery gives the manufacturer suggestions which he in turn is able to make available to all users.

If the purchasing agent of a rock products company would play safe he should at least test his skepticism by consulting with engineering and operating officers of his company before assuming an arbitrary attitude. For example, a machinery friend informs me that not long ago

Another view of a manufacturer's parts stock room to show the large number of items which it is necessary to carry in stock

he had an inquiry for headliners for one of his types of grinding machines, and was requested to bid according to drawings supplied by the user. He found these drawings were copies of his own parts. This, of course, costs money but this is not considered in case a competitive price is cheaper than the price of the original manufacturer. It is much cheaper to make a drawing by copying the dimensions from an existing part than it is to design that part originally. Designs of all machine parts require great study and calculations and cost plenty.

To get back to our story, our friend found that the drawings covered the last shipment of headliners he had made to this user about four or five years before and were a design that shortly after its inception had been abandoned and was absolutely obsolete. It has been replaced by a new design which has certain features of quite some importance and have increased the life of the liners considerably and also the life of the head plates, although without additional expense.

This matter was called to the attention of the purchasing agent, said my manufacturer friend, but he stated he had asked for a price on parts according to drawing submitted by his engineering department, and that was all that he was required to do, and as the price he had obtained elsewhere was slightly less he placed the order elsewhere. In other words he saved perhaps $50 in first cost and lost many times this amount in his total repair bill.

In considering the matter of price, the purchaser of repair parts should remember that the original manufacturer is normally in a position to make the part as cheap as or cheaper than a local foundry or machine shop. His price may be much higher and still be fair to his customer. He may use superior materials. He may have improved the design. He may have made a large investment in plant and equipment purposely to give his customer quick and efficient service.

Perfect Fit Saves Cost

There are some parts of machines that undoubtedly can be obtained locally to advantage; but there is a cost item in making repairs and replacements often ignored. That is the cost of the additional time of the repair gang frequently required in making local castings fit. Drawings and patterns made from worn parts are not likely to make a perfect fit. On the other hand the original manufacturer probably has designed special templates, jigs and fixtures so that his parts are really standard and accurate to scale.

Moreover, after a little experience with repair parts the manufacturer often purposely designs them to be more readily replaceable. By close coöperation between the user and the manufacturer, the user often gains the advantage of much expert advice on installing repair parts and other advice on operating problems gleaned from contacts with many other users. The service departments of many machinery manufacturers are frequently the best source of expert advice on particularly knotty operating problems.

Commercial Considerations

We have attempted to put ourselves in the position of a prospective purchaser of repair parts—with a skeptical mind—and thus review some of the reasons given us why we should

(Continued on page 32)

Partial view of crusher parts carried by one large manufacturer for immediate delivery as a service to the industry

What Changing Screens Costs

ARTICLE FIVE

On Crushing, Sizing, Testing and Specifying Aggregates Deals With Screening Costs

By ELWOOD T. NETTLETON

Few operators really appreciate the actual costs of changing screens to meet changed specifications. Since the annual expenditure for screens by the company with which I was formerly associated had been on the increase for several years, it was deemed advisable to take an inventory of the investment in screening surfaces, and to list salient points in order that this information might be placed before consumers and engineers when questions of annual revision of specifications come up.

There is considerable variation in both the life of screens and the cost of screens. The life of a screen depends upon the material of which it is made, the diameter of rod, the thickness of gauge or plate, the tonnage passed over and through it, the kind of stone being screened, the type of screen such as vibrating, shaking, or rotating, and the manner in which the load is applied to the screen. The cost of a screen depends upon the material of which it is made, the diameter of rod, the thickness of gauge or plate, heat treating, welding and rolling.

With these factors in mind, the most economical screen would be that which costs the lowest per unit ton for a given unit period of time, provided the screening efficiency of the various types of screens were equivalent. Practically, the screening efficiencies are not always equal. Furthermore, at present, quarry operators, unfortunately, have to give considerable attention to obsolescence of screens, due to periodic changes in specifications by engineers. This latter factor often makes it wiser to purchase low cost screen material with a short length of life, which is not usually the most economical as to the unit cost per ton for a given period. Owing to quicker wear, this screen may not provide as uniform screening throughout the life of the screen as one of more durable material. However, the shorter life of the screen may bring about its fulfilling its ultimate service before some engineer may change his mind about specifications for stone sizes, with the result that there might not be any obsolescence.

Relative Costs of Screening Surfaces

The figures listed below show average prices per sq. ft. for screen sections f.o.b. factories as of December, 1937. These prices do not include any rolling or welding charges on screen cloth. On the High Carbon Steel Plate, the thickness of plate is approximately the same as the diameter of the rods. The size openings and diameter of the rods given are not the only ones used but are those in general adopted in the southern New England territory for use where hard rock, such as trap, is crushed and screened.

The prices below do not include any rolling or welding charges on screen cloth — on the High Carbon Steel plate, the thickness of plate is approximately the same as diameter of rods.

SIZE IN SQUARE OPENINGS	DIAM. OF ROD.	MANGANESE	HIGH CARBON ALLOY SPRING STEEL	HIGH CARBON STEEL PLATE
2⅝ in.	0.625 in.	$2.36	$1.40	$1.87
2½ in.	.625 in.	2.45	1.43	1.87
2 in.	.500 in.	1.96	1.29	1.49
1¾ in.	.500 in.	2.25	1.38	1.49
1½ in.	.4375 in.	1.89	1.27	1.21
1¼ in.	.375 in.	1.96	1.27	1.21
1 in.	.3125 in.	1.76	1.10	.88
¾ in.	.250 in.	1.58	.99	.94
½ in.	.192 in.	1.96	.75	.83
⅜ in.	.162 in.	2.72	.66	.72
¼ in.	.135 in.	2.51	.61	.72
3/16 in.	.120 in.	2.23	.64	.72
⅛ in.	.092 in.	——	.66	.66

The price on steel plate includes heat treating for vibrating screens.

Life of Various Screen Surfaces

The figures shown on page 32 give the approximate comparative ratings of various types of screen media as compared with high carbon steel.

Two sizes of dust are separated over this screen which precedes another over which larger stone is graded

This information was obtained from T. W. Jones, engineer with the New Haven Trap Rock Co.

	Times Length of Life
High Carbon Steel	1
High Carbon Alloy	1.2 to 1.7
Manganese	2.0 to 3.0

A general table of the most economical screen for any particular size has been purposely omitted because of the changes in market prices of steel and the continual improvements of treatment of steel and alloys. The selection of any particular screen section is a problem by itself in which price, life, efficiency, installation costs, and obsolescence must all be considered.

The installation costs of screen sections vary according to the type of screen. It is necessary that screens be changed while the plant is not operating. Inasmuch as this is usually done at night there is no loss of operating time. To change the sections of a large cylindrical scalping screen would cost about $25 per section for labor only, whereas the change of a small vibrating screen section might not amount to over $2 per section. Oftentimes, especially with the scalping screens and others with large size openings, as many as five or six sections are used.

To show the heavy costs to a producer caused by the changing of a set of specifications by one single large consumer, such as a state highway department, the writer is assuming a hypothetical case.

Assuming that the State Highway Department of Connecticut decides to change its set of stone specifications, effective at once, the approximate cost to the New Haven Trap Rock Co. for new screens alone would be over eleven thousand dollars. In addition to this cost there would be freight charges, labor charges, obsolescence of old screens, obsolescence of material in stock and many other losses.

The calculated summary of the costs of these screen changes in the five quarries now in operation is as follows:

Total number of screens to be changed	52
Total cost of screens	$11,256.32*
Total sq. ft.	6,825
Average cost per sq. ft.	$1.15

*Based on 1938 costs, present screening areas and present screening media.

From these figures the costs, which are not usually considered by the engineer, appear staggering even without obsolescence. Unfortunately, obsolescence of material is a much more serious loss and will be discussed in the next article under tonnage of material in stock.

(To be continued)

Repair Parts

(Continued from page 30)

buy of the original manufacturer rather than from a local foundry or machine shop. We have no grievance against the local shop as such. Sometimes they have working arrangements with the original machinery manufacturer and are supplied with patterns and equipment to make repair parts on a license or royalty basis. That might result in a substantial saving of transportation costs.

The point is that to be fair in these dealings with machinery manufacturers we should remember that he has developed a piece of equipment and sold it to us with the expectation that it would require repair parts and replacements from time to time. He undoubtedly makes his selling price on the original machine with that in mind. If he is deprived of the repair part business and wants to keep out of bankruptcy there would be nothing else left for him to do but increase the price of the original machine, so that he would not have to rely on any repair part sales to follow.

Of course, the repair part business can be and has occasionally been made a racket; at least in the opinion of some purchasing agents; but it should not be assumed that it is a racket simply because the original manufacturer asks a higher price than the local foundry. For example, it might be a manganese-steel part that is required. There is no general understanding of what constitutes manganese-steel. Reputable manufacturers say it is an alloy of 10 to 16 percent manganese with 90 to 84 percent iron and carbon (steel). The local foundry may bid on a 3 or 5 percent alloy, which has none of the properties of genuine manganese steel.

Another angle is that many machines and parts are patented and the user or the local foundry may be violating someone's property rights in having the part made. Generally, of course, a manufacturer will overlook such delinquency on the part of an otherwise good customer, but the practice will exempt the manufacturer from legal responsibility given in any performance guarantees. Moreover, the user of a machine who makes a practice of buying repair parts made by others than the original manufacturer can hardly expect the manufacturer to service the machine as he would otherwise be glad to do both for his own reasons and the customer's.

In later issues, probably, we shall take up some of the specific things that can go wrong when a shortsighted policy leads us to buy the lowest priced part rather than the most serviceable one—which nearly always is the cheapest and most economical buy in the long run.

One of the vibrating final sizing screens used in supplying T.V.A. aggregates

PROGRESS IN THE CEMENT INDUSTRY

POZZOLANA CEMENTS

By NATHAN C. ROCKWOOD

Some 2000 years after their efficacy had been proved, pozzolana cements are coming into recognition in the United States as an engineering structural material. If a small fraction of the time and effort that has been spent in research on concrete and mortars had been spent studying the history of engineering, especially engineering materials of construction, pozzolana cements would have received recognition long ago—probably would have been well established in this country along with natural cements before the era of portland cement. As it was, a few progressive West Coast portland cement manufacturers started the ball rolling only a few years ago.

Pozzolana cements have not been unknown here—except by that name, for the old and well-known Magnolia brand of nonstaining masonry cement is a pozzolana by another name. A true pozzolana cement, we presume, is a mixture of an active silica (and alumina) ingredient and lime (oxide or hydrate). The Romans apparently used quicklime and various pozzolanic materials, most of them natural products, but some were pulverized clay products, such as potsherds. Much of their mortar and concrete made with these cements is still good.

The present interest in pozzolana cements is directed mostly to portland cements to which a pozzolanic material has been added. The definition of this new product is given in Federal Government Specification SS-C-208 as C-1, "portland pozzolana cement shall be an intimately interground mixture of portland cement and those natural or artificial products composed essentially of silica and alumina, and which will react in the presence of water to form a hydraulic cement when finely ground with lime or lime compounds, or portland cement."

In our humble opinion that is an exceedingly awkward and ambiguous definition—with at least two breeches of good grammar. In it, apparently, the writer has attempted to define not only a portland pozzolana cement, but also a pozzolana. The portland pozzolana cement is the interground mixture of cement and pozzolana; and the pozzolana is a product which will react with lime or lime compounds to form a hydraulic cement.

The last is important, and failure to comprehend the true meaning of pozzolana, or puozzolana, or puzzolana (take your choice, they're all acceptable!) accounts for a lot of confusion in the cement-using fraternity. The virtue of portland cement seems to lie in the fact that in calcining together a mixture of limestone, silica, alumina and/or iron, and pulverizing the product to provide surface area, the lime and silica and alumina have been put into forms which readily react with each other in the presence of water. The end products are some simple calcium hydrosilicates, hydrated lime and unhydrated clinker aggregate. In the case of portland cement these reactions take place rapidly, and therein lies its prime virtue.

Something like the same results and the same end products are accomplished much more slowly by mixtures of lime and some active form of silica and/or alumina. Nature does the activating of the silica and alumina in many cases and pozzolanas are found as deposits of volcanic dusts or tufa. Calcining silica and alumina artificially at not too high temperatures accomplishes somewhat the same purpose. Possibly merely very fine grinding of silica makes it chemically active with lime. The sand-cement, so-called, made by the city of Los Angeles at the time it operated its own cement plant at Monolith, Calif., evidently had some pozzolanic properties although made merely by grinding portland cement clinker and sand together.

It probably is not essential, as the Federal specification requires, that the cement and pozzolana be interground, which we presume means grinding together. If both the cement and the pozzolana were ground separately to the proper gradation, an intimate mixture would be sufficient. The difficulty, of course, is to get an intimate mixture in any other way. This has been the trouble in attempting to sell pozzolanic admixtures for incorporation with the cement on the job. Probably some of these admixtures are genuine pozzolanas, but results with them have varied greatly on different jobs or with different cements, due perhaps to lack of their thorough distribution in the cement.

Strictly speaking a portland pozzolana cement is not a portland cement with a pozzolana admixture, but a cement made by using portland cement clinker and a pozzolana as raw materials for a distinct product. The pozzolana is just as much a part of the finished cement as the other silica and alumina which is in combination with lime (temporarily) in the clinker. Using portland cement instead of lime as one of the ingredients of a pozzolana cement merely helps speed up the reactions, which ultimately appear to yield the same end products.

Pozzolana cements have the disadvantage of being slow hardening

(Continued on page 53)


Argentina
Australia
Belgium
Brazil
British India
Canada
China
Chile
Colombia
Czecho-Slovakia
Denmark
Eire
England
Estonia
Finland
France
French Indo-China
Germany
Hungary
Iran
Italy
Japan
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Morocco
New Zealand
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The illustrations show some of the installations of Smidth machinery in various countries. Space does not permit showing all. However, Smidth machinery has been supplied to
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250
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have been installed throughout the world
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In addition to rotary kilns and Unidan Mills, Smidth equipment includes a complete line of machinery, such as ballmills, tubemills, coolers, agitators, washmills, pumps, conveyors, packers, separators, etc., with accessories, for use in Cement, Lime and Ore plants.
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Fig. 1: One of three consecutive belt conveyors delivering stone from the quarry floor into storage bins

Long Conveyors and Diesel Trucks Cut Quarry Costs

Substantial reduction in production costs through modernization of haulage system and improvements in raw material crushing

By BROR NORDBERG

TO REDUCE operating costs materially, the Coplay Cement Manufacturing Co., Coplay, Penn., is now transporting crushed stone almost a half mile over belt conveyors from the quarry into the stone storage bins in the mill.

Since September, 1938, when the crushing plant was remodeled and the conveyors were started up, production costs have been reduced materially, entirely due to more modern facilities in handling stone ahead of the ball mills. All crushing is now centered in the quarry, with direct delivery of the crushed product into the stone house.

Trucks operating in the quarry have displaced industrial cars pulled by 8-ton gasoline locomotives. The deposit is in the cement rock section of the Lehigh Valley but there are variations within the quarry itself

Fig. 2: Automatic scales which weigh and record tonnage taken into stone bins. Fig. 3: Self-propelled, motorized tripper which distributes stone into storage through a three-way chute. Fig. 4. Transfer station where stone is relayed from 1265-ft. conveyor to one on 495-ft. centers. Note magnet in background

Fig. 5: Rebuilt crushing plant, showing the working face in background and inclined conveyor tunnel on right

Fig. 6: Diesel-powered trucks are dumped by a pneumatic tilting device, stone discharging into primary crusher

Fig. 7: Body of truck dumping stone into primary crusher

which are taken into consideration in excavating raw material for the various cements. Well-defined ledges are evident where a selection of stone for manufacturing standard, low heat, sulphate-resistant and high early strength cements is desirable and trucks have given the needed mobility. The main quarry face is 140 ft. in height, but a high-in-lime stone is being excavated 100 ft. farther down in a remote corner. Trucks also operate on this level, a 5-ton skip being used to stockpile this stone on the main quarry floor. Two Ford trucks carrying five tons to the load are used in this work.

Diesel Trucks With Special Bodies

In the main quarry, a 2½-cu. yd. electric shovel loads into two Hug Roadbuilder trucks having 6-cu. yd. Easton Phoenix side-dump bodies. These trucks are powered by 4-cycle, 6-cyl. Buda Diesel engines which at 2600 r.p.m. have a rating of 107 b.h.p. Costs are unusually low, despite the fact that the length of haul is only 900 ft. and the gears are shifted eight times in 1½ minutes. In an 8-hr. day, the trucks combine to haul 1300 to 1600 tons, averaging 8 tons to the load. Fuel costs average 55c per truck for 8-hr. operation and the lubricating oil is a negligible quantity. Truck bodies are dumped by an Easton pneumatic lift into a No. 10 McCully gyratory crusher.

This same crusher was formerly operated at the head of an incline outside the quarry, and the industrial cars, then used, were pulled out of the quarry by a 125-h.p. hoist to discharge into it. A minus 1½-in. discharge was elevated into two storage bins and dispatched into cars which were hauled by two 16-ton gasoline locomotives to the cement mill over one-half mile of narrow gauge track. At the cement plant, a hammer mill reduced the stone to ball mill feed size.

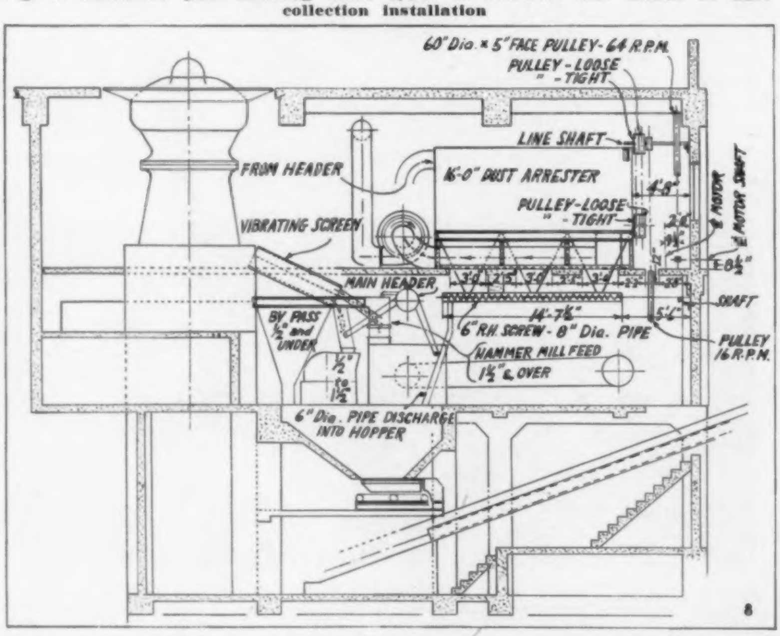
All Crushing Is Done Within the Quarry

All the crushing is now done within the quarry. The primary breaker discharges stone over a 4- x 7-ft. 6-in. Link-Belt double-deck vibrating screen, which serves to separate out fines needing no further reduction, and to distribute the remainder into two hammer mills.

Two hammer mills are used because neither by itself had sufficient capacity. Plus 2½-in. stone off the top deck is chuted into a 24- x 48-in. Pennsylvania hammer mill, ½- x 1½-in. stone is the feed for a 36- x 30-in. hammer mill, and minus ½-in. material by-passes both—the three products joining in a common 15-ton surge bin from which it is fed out to a belt conveyor over a 36-in. x 5-ft. Link-Belt apron feeder.

Distribution of cement rock from the vibrating screen is about 50 percent to the large hammer mill, 12½ percent through the other and 37½ percent by-passing both mills. On the high-in-lime stone, with the same setting of the primary crusher and identical screen decks, the distribu-

Fig. 8: Elevation plan showing three types of crushers and details of dust collection installation



tion is 40 percent, 35 percent and 25 percent, in the same order. Inequalities in the distribution are due to more re-handling of the latter stone and the subsequent breakage. A 16-ft. Sly dust collector removes dust arising at the discharge of the gyratory crusher, from the openings into the hammer mills, and at the hopper discharge. Collected dust is returned into the hopper.

Unusually Long Conveyor in Tunnel

The conveyor system was designed to deliver in three days enough cement rock into the mill bins for a week's operation of the cement plant at a 2400-bbl. daily rate of production; and consists of three conveyors in succession operating in a tunnel of unusual design.

In cross-section the tunnel is about 7-ft. in height with an arched top and vertical sides. The ground is the bottom of the tunnel where it conforms closely to the contour, and for some of the length the underside of the tunnel is open except for the walkway. Construction is of 3/8-in. expanded metal lath on a steel framework, covered with two coats of cement plaster on the inside and one of waterproofed cement mortar outside. Expansion joints are provided at 72-ft. intervals.

Conveying is done by a series of three belt conveyors, aggregating a total distance of 2012.62 ft. from the tail pulley of the first one under the crushers in the quarry to the head pulley of the third in the stone building. Each of the belts is 24-in. wide and is run at the rate of 525 f.p.m. The first conveyor, on 465-ft. centers, takes the stone out of the quarry. A cut was made through solid rock to reduce the angle of elevation of the conveyor, and the tunnel casing was given added strength through the cut and beneath a highway just outside the quarry by constructing it of reinforced concrete for that interval of length.

This conveyor has a 21½ deg. rise and a vertical lift of 159.3 ft. to a transfer station where the load is taken over by a second belt conveyor. The second conveyor, on 1265-ft. centers, follows the contour of the ground which is practically horizontal and transfers to a third conveyor, 495-ft. centers, which has an 8 deg. rise to the stone storage house. Its travel is horizontal for 123.5 ft. in the stone building. Tonnage produced is recorded by a Merrick belt Weightometer just after the second transfer is made.

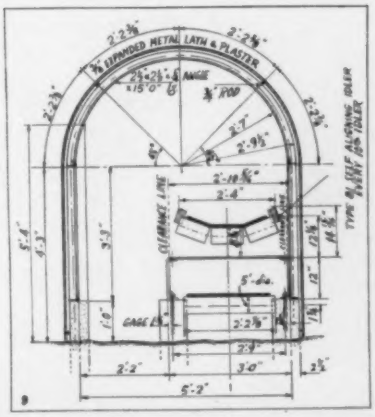


Fig. 9: Construction details of tunnel made with expanded metal lath and plaster which houses long conveyor

In the stock house, stone is stored by a Link-Belt self-propelled, self-reversing, motorized automatic tripper through a three-way chute. The building, 40- x 125-ft. in plan, has a lengthwise partition wall, and holds 5000 tons of stone in each half. From storage, stone minus ½-in. is reclaimed over 20-in. and 30-in. belts into the dryers. The next step is the use of Poidometers, the placing of dried stone into storage, and pulverizing in open circuit to 80 percent minus 200-mesh in 18 Fuller mills.

The conveyor idlers, Link-Belt Co., are three-pulley, roller bearing troughing idlers on the carrying side, with every tenth one a self-aligning idler. Conveyor No. 1 is driven by a 50-h.p. motor, No. 2 by a 25-h.p. motor and No. 3 by a 20-h.p. motor, the drive for all three being transmitted by Link-Belt motorized speed reducers. Belting was furnished by the Boston Woven Hose & Rubber Co., Boston, Mass. For the conveyor carrying stone up the 21½ deg. grade, a 6- x 4-ply, 42-oz. duck is used, and 4-ply, 32-oz. duck is used for the other two conveyors.

In the illustrations may be seen the difficult terrain over which the conveyor tunnel was constructed to reach the cement mill buildings. This tunnel conveyor is probably one of the longest in use by any cement plant in the country.

The entire project was designed, and equipment was specified by plant engineers under the general supervision of D. J. Uhle, vice-president in charge of operations, and company forces were employed to do the work. About 3000 to 4000 cu. yd. of earth and rock was excavated in the preliminary work. The project was completed in five months, without interference with mill operation and using company products wherever possible.

Fig. 10: Cement plant in background with stone conveyor tunnel from quarry in foreground

Fig. 11: Single belt conveyor on 465-ft. centers carries stone from the quarry up 21½ deg. incline with a 160-ft. rise

Fig. 12: Tunnel exterior shows arched construction and concrete foundation posts

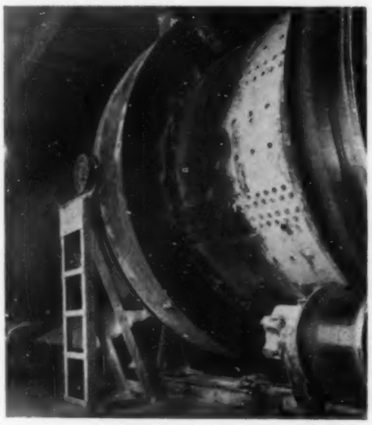
Fig. 13: Belt in tunnel is inclined upwards to the self-propelled tripper in storage building

Making An Industry Dustless

Cement and rock products industries are rapidly eliminating dust in all the processing operations from the quarry to the packhouse

By BROR NORDBERG

PROGRESS in the elimination of dust from cement processing operations in the past few years has been so rapid that it is not unreasonable to believe that within a short time the industry from a practical standpoint will be comparatively free from this vexing problem. While it may be difficult to show increased productive efficiency in every case, the industry eventually will find some substantial gains from expenditures to eliminate dust.



Feeder (Minogue) which is being used to return flue dust to the cement kiln

Dust collection in the cement industry involves two fundamental problems: the removal of dust from the kiln gases and its return to the system or disposal for agricultural and other purposes, and the collection of dust around crushers, screens, elevators, conveyors, grinding mills, dryers, packing machines, etc., and its return to the system. Where dust collection systems are properly designed and the installation is made in accordance with good engineering principles, they are invariably working out efficiently.

Some of the early difficulties encountered with dust collection systems were brought about by improper design and location of hoods and pipe connections. Dryers for rock, shale and other ingredients are a separate problem as the air is at high temperature, is saturated with moisture, and may have diluted sulphuric acid in the combustion gases. The condensation problem and the presence of acid requires filter materials which are acid-resisting.

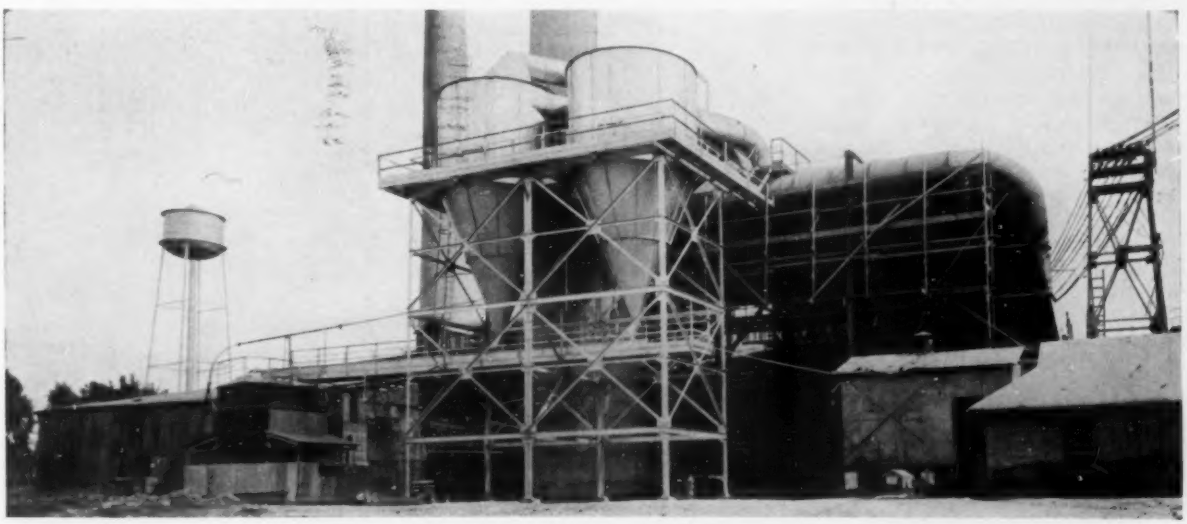
The different types include: the electrical or Cottrell precipitator; the cloth filters; and cyclones, either single or in multiple. The Cottrell is highly efficient on dusts of every character except a few which require some conditioning to permit ionization. The draft loss is low, and the cost of operation is not excessive.

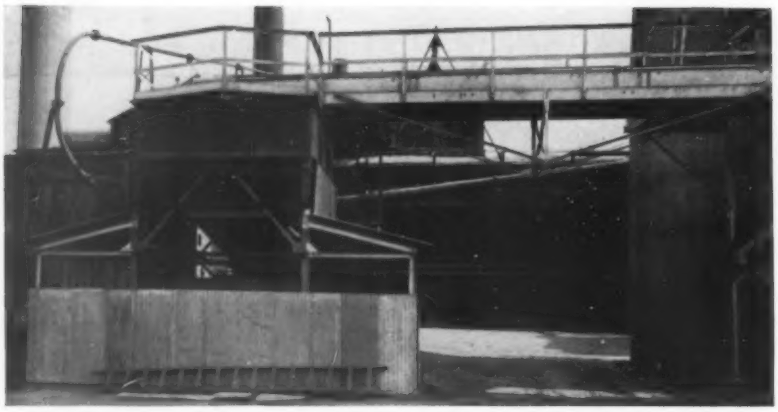
Cloth filters of several types are used. These may be either of the tubular or the flat cloth form. Cleaning or shaking down of the cloths is accomplished automatically and at frequent intervals, so that volumes of from 2 to 6 cu. ft. per min. may be passed through each square foot of cloth, with a draft loss of from ¾-in. at the start, increasing to 2½ in. just before shaking down. Cloth filter and electrical precipitation types are capable of attaining from 98 to 99 percent efficiency of collection. The cost for either of these types is said to be about the same per unit of capacity. It is desirable, of course, to precede these types of collectors with a cyclone to drop the heavier dust and thus to relieve the more efficient apparatus of part of the load.

Another type recently perfected has a granular filter in which the dust-laden gases pass through beds of screened pebbles. There are also several wet type collectors.

It is necessary to turn to the actual plant installations themselves to find how they may be best applied. Complete operating and installation data on the Buell system installed at the

View of two Norblo uninsulated cyclone collectors for two kilns of the Louisville Cement Co., Speed, Ind. plant. Discharge from bottom of cyclones goes to a horizontal screw and thence to the conveyor on the left





Aerated conveyor for transporting flue dust back into kiln feed hoppers, Louisville Cement Co., Speed, Ind. Note pipe-line on left and receiving hopper over cylinder and horizontal conveyor feeding it

Wampum, Penna., plant of Medusa Portland Cement Co. appeared in the July, 1939 issue of ROCK PRODUCTS. Similar equipment is being installed at three other cement plants and has been ordered for another plant.

Petoskey Portland Cement Co., Petoskey, Mich., has been installing dust collecting equipment to collect and utilize stack dust. Equipment comprises eight No. 28 and eight No. 30 type D Sirrocco dust collectors and the necessary induced draft fans, all furnished by the American Blower Co. Conveying and elevating equipment also is being installed to handle the combined dust collected by the collectors and that which is precipitated in kiln housings, boilers and economizers. This equipment, furnished by the Link-Belt Co., consists of drag and screw conveyors and rotor lifts. To feed the collected dust back to the kilns and to storage bins, screw conveyors in connection with Minogue flue dust feeders are being used. The Minogue flue dust feeders and the storage bins were provided by the Manitowoc Engineering Works.

Kosmos Installing Three Types

An outstanding example of the extent to which the modern cement plant management has become "dust conscious" is the mill of the Kosmos Portland Cement Co. at Kosmosdale, Ky., where three types of dust collectors are being placed into service. When completed, this mill likely will be one of the most dust-free in the industry.

Six nests of four Buell cyclone collectors, 24 units in all, with a rated capacity of 300,000 c.f.m., are already in service to recover dust from six kilns exhausting to a single stack. Efficiency of the system is 84 to 87 percent recovery of all dust particles in the exhaust stream. The problem in any dust collection installation after the dust is gathered, is how to use it to advantage, and Kosmos evidently is blending it very effectively into the kiln feed material. The hoppers discharge automatically into a single screw conveyor and all the dust is elevated by mechanical bucket conveyor into a 500 ton steel bin, from which it is proportioned out into the raw material mill stream. Raw material is ground in closed-circuit, air separators and tube mills, with the separator fines from both gathered by screw conveyor. The flue dust is released to a Fuller-Kinyon pump through a variable-speed-driven Fuller rotary feeder and is pumped into a hopper over the aforementioned screw conveyor and so distributed in definite amounts into the normal kiln feed material.

The 13 to 16 percent dust exhausting through the stack is not desired as kiln feed material, but some thought is being given to installation of a wet-type air filter between the dust collector and the stack should there be developed a market for these fines. This would give a 100 percent recovery of dust from the stack gases.

Similar collection units, of 20,000 c.f.m. capacity, are going into the raw mill section to recover dust from all sources where it is generated—this also to be returned into the mill stream. In the finish grinding mill a Cottrell electrical precipitator is used to recover a high percentage of cement which would ordinarily escape as dust.

The third type of collector to be installed is the Norblo bag-type unit, a 6000 c.f.m. collector going into the packhouse, and a second one of identical capacity in the river packing plant.

Stack dust losses have been sharply reduced at Louisville Cement Co.'s Speed, Ind., plant with installation of cyclone stack dust collectors, and a large part of the valuable dusts are being returned into the raw mill stream.

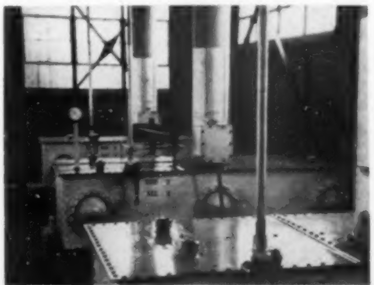
As the cement mill is located in the cement village of Speed, far from other residential zones, there were no compulsory demands for eliminating dust. The company desired to reclaim wasted material within practical and economical limits and to better living conditions for mill workers in the village.

Louisville Cement Co. Installation Applied in Two Ways

The mill is a dry process plant of 5000 bbl. daily capacity, having six kilns, two 7- x 100-ft., two 8- x 10- x 160-ft. and two 10- x 150-ft. Ordinarily the two smallest kilns are not run. Raw material is ground to a fineness probably exceeding that attained in most plants. Fineness of kiln feed probably has a lot to do with quantities of unburned and partially-burned material contained in the exhaust gases.

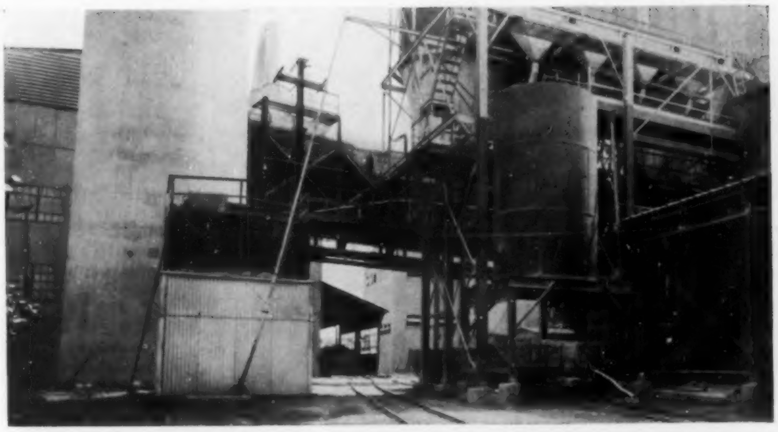
Gases from the two 10- x 150-ft. kilns are exhausted to a Babcock and Wilcox 1500-hp. waste-heat boiler, and are drawn through a Sturtevant economizer. Gases from the other four kilns are similarly handled through identical equipment, and until two years ago, each economizer exhausted direct through a flue to separate 12 x 300-ft. concrete stacks. Of course, some dust was settled on the boiler tubes and more was recovered in the flues, or expansion chambers, ahead of the kilns.

Above: Diamond plant of Superior Portland Cement, Inc., Seattle, Wash., equipped with electrical dust precipitators. Below: Dust conveying screw under hoppers of precipitators



About two years ago the first stack collector was placed into operation serving the four kilns — ordinarily using two kilns. The collector consists of three 14-ft. diameter Norblo H.E. L.S. flue dust cyclones, designed to handle 100,000 c.f.m. but actually handling 80,000 c.f.m. in normal 2-kiln operation. These units are probably the first of their type and make applied to remove stack dusts in the portland cement industry.

More recently, a collector of the same make and design and consisting of two 15-ft. 4 in. cyclones has gone into service on the other stack serving two kilns. This unit was designed for 70,000 c.f.m. The dust loading going to the original installation is normally higher than that going to the recent installation because of the higher gas velocities through the calcining zone of the 8- x 10- x 160-ft. kilns.



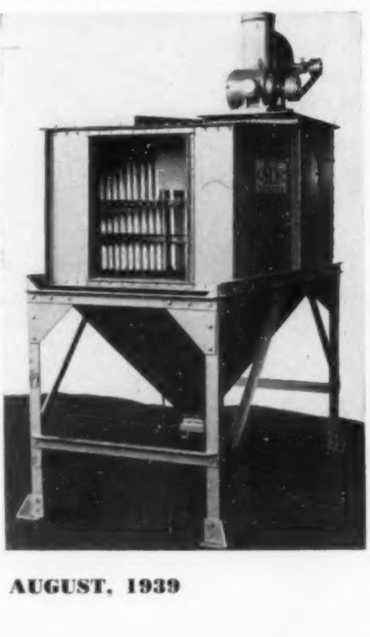
Another view of Louisville Cement Co. installation, showing three insulated Norblo cyclone collectors which receive gases direct from waste heat boiler. On left, in front of stack, is located pneumatic pump for transporting flue dust

Dust Collection Installations Are Different

Methods of installation of the collector cyclones, which are in parallel, are different in the two cases. The earlier system, operating under negative pressure, is connected into the exhaust gas circuit between the waste heat boiler and the economizer due to limitations in the plant. With this hook-up it was necessary to insulate the cyclones with magnesia block to reduce radiation losses, thus keeping the gas temperature up for use in the economizer.

With the more recent installation, under positive pressure, gases are received from the discharge side of the fan and therefore it is more efficient from a heat recovery standpoint. The temperature loss of about 50 deg. F. through the collectors is probably compensated for in part by reduced wear on the economizer fan blades in the case where the gases go direct to the collector from the waste heat boiler.

Dust collector unit of the cloth filter type which is being used to remove dust around crushers, conveyors, etc., applicable where not more than 3000 cu. ft. of air per minute is required



Operating data on the new collectors are meager as yet, but they are recovering the bulk of the dust desired to be blended into the fresh kiln feed material. Recovered dust is low in alkalis and, in the case of both collector systems, is being returned directly to the kiln bins.

Collector Efficiency

On the earlier installation, about 75 percent of the total solids in the gas stream is recovered. Recovered dust is about 82 percent minus 325-mesh, and that lost runs 99.8 percent minus 325 and 32 percent under 7.5 microns. Collection efficiency is of course dependent upon dust collector design and also on the character and fineness of dust in the kilns. The degree of fineness to which kiln feed material is ground very likely has an effect on the range of particle sizes and therefore on the efficiency of collection with the cyclone-type units. The three-unit collector exhausts at about 420 deg. F. with a pressure drop of 2 in. overall, and the other collector has an identical pressure drop while exhausting at about 325 deg. F.

Two Methods of Transporting Stack Dust

Dust, once removed, always presents the problem of utilization. Temporarily, dust from both systems is being put into the raw material stream in the kiln hoppers—dust recovered from either pair of kilns returning with fresh material into the same kilns.

Two methods of transportation are used. The illustration shows how dust enters each cyclone through ducts from the old expansion chambers. On the newer setup, with two cyclones, dust is constantly being trapped and the cyclone exhausts, containing the extremely small micron particles, return into the chamber. Each cyclone continuously discharges dust into a common screw conveyor, and it is then carried into a hopper feeding a Robinson air-activated conveyor.

This system consists of the receiving hopper overhead, and a cylinder in which the material is released and activated by compressed air that forces the material through a pipeline to its destination. In this particular plant, the system is manually operated once each shift, with dust collecting constantly in the receiving hopper. Compressed air is furnished from the central compressor station, and when released into the cylinder as the dust is fed in, must build up to a pressure of 20 to 30 p.s.i. to induce the material to flow through a 3-in. pipeline. The discharge is split into the kiln feed hoppers. About 15 to 20 tons per day are recovered.

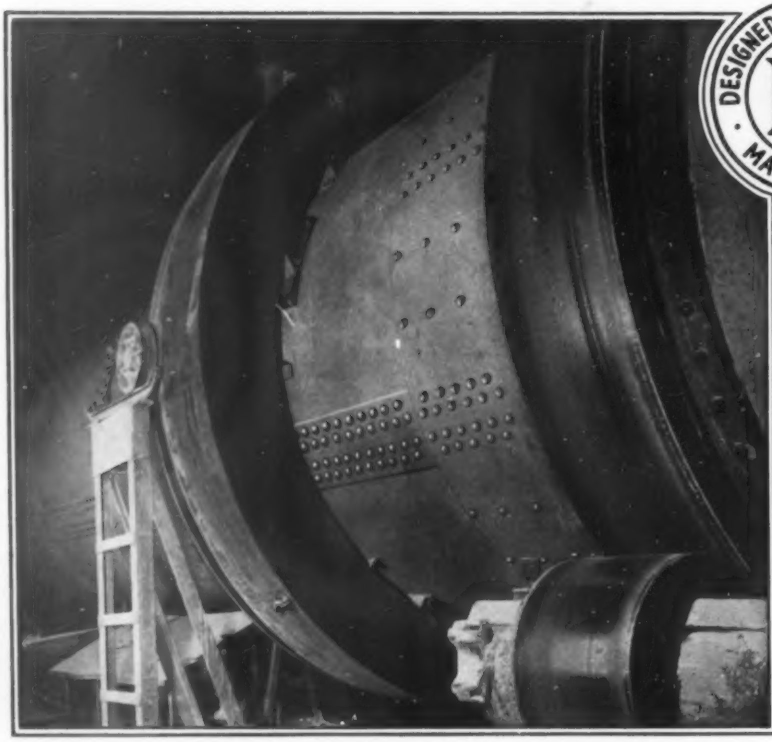
Similarly, the dust is handled to a hopper in the case of the older collectors, to be transported to the kiln-feed hoppers by a 4-in. type C Fuller-Kinyon pump. This collector is recovering 35 to 40 tons of dust daily.

A similar Norblo 14-ft. diameter single cyclone collector is now being installed to recover dust from the rock and shale driers. Dust will be returned by a screw conveyor into the flow of raw material and be reproportioned over scales.

After the dust collecting installations at the Speed, Ind., plant of Louisville Cement Co., have been in service a longer period more data will be available.

The MINOGUE KILN FEEDER

for Rotary Kilns



10 Ft. Cement Kiln Installation of MINOGUE KILN FEEDER

Modern dust collecting systems have demonstrated their ability not only to abate dust nuisances, but to recover substantial amounts of valuable material.

Suitable equipment, however, is required to reintroduce this material into the manufacturing process.

The MINOGUE KILN FEEDER solves this problem by feeding the reclaimed fine dust directly into the calcining zone of the kiln. In addition, it may be employed to handle original kiln feed in dry process plants.

Advantages:

- **Dusting minimized—material fed under kiln charge.**
- **Feed is introduced thru shell at any point along kiln.**
- **Ring trouble is prevented—material entered at calcining zone.**
- **No additional motors required—feeder mounted directly on kiln.**
- **Capacities up to entire volume of kiln feed obtainable.**
- **No moving parts—hence negligible maintenance.**
- **Operates without supervision.**
- **Readily installed on existing kilns.**

Kiln operators interested in obtaining further information on the Minogue feeder, the Vanderwerp Recuperator, or other Manitowoc equipment, are requested to write, without obligation, for full particulars.

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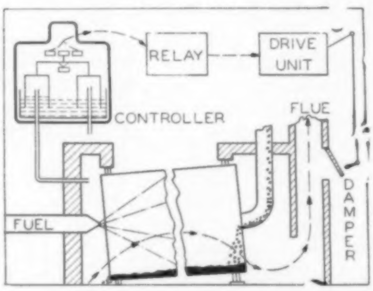
Instrument Control In the Manufacture of Cement

Specifications for special cements call for closer control of operations through instruments and control devices

By RALPH S. TORGERSON

LESS THAN A DECADE AGO the use of instruments and instrumental controls in the manufacture of cement was looked upon with skepticism and as innovations of little practical value. True, instruments were to be found in some of the modern cement plants of that period but they were often covered with dust and not put to any practical use. Even the instrument manufacturer lost interest in the cement industry as a market for his products because of the indifference of those charged with the use of the instruments and the high cost of servicing equipment.



Showing how Leeds & Northrup kiln draft control is installed. Equipment consists essentially of a controller, a relay and interrupter, and a drive unit

In recent years the picture has entirely changed. No longer does dust cover the instruments, and much more apparatus is being added to help reduce costs and improve the product. Every step in manufacture from the quarry to the packhouse is now being critically examined to determine whether some better means of control may be introduced to improve operations.

Screens, conveyors, and elevators handling materials are interlocked and controlled by means of a combination of line starters and air circuit breakers. In case of failure of any equipment, all machinery preceding the point where the trouble exists will cease to operate until it has been corrected. Individual electric motor drives with power indicating and recording meters, have permitted this flexibility in operation.

Further refinements have been made in the wet process cement mills in which close control is exercised over the raw material feed by a new flotation process.[1] An example of this control may be found in the new Argentina Portland Cement Co. plant, and it is expected that several cement companies in this country will make similar installations. The latest one, now under construction, the Permanente Corp. plant, California, will have it.

Electric "Ears" and "Eyes"

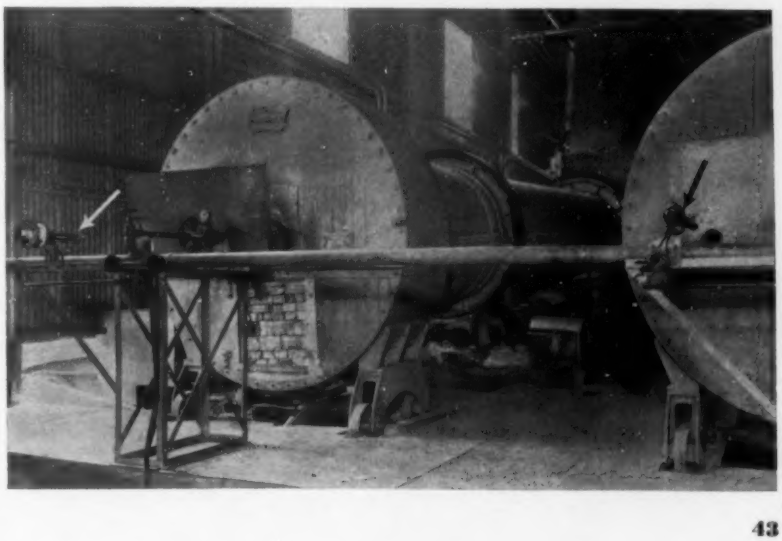
Another automatic feed control is the "electric ear" to govern the feed in grinding raw materials or clinker. The device comprises a properly tuned microphone, instrument panel, and electrical connections to operate the feed mill mechanism. When the mill sounds "dead" or too quiet, the feed rate is automatically reduced and similarly when the sound is too loud the feed rate is increased. Its purpose is to maintain a constant sound level in the mill. Complete details concerning this device may be found in ROCK PRODUCTS, January, 1939, p. 44.

A more recent development is the use of the "electric eye" to control the speed of the kiln in accordance with burning conditions. Further details about this device will be published in a separate article.

Perhaps the greatest development in instrumentation and automatic control has been in the calcination process. Complete instrumentation of cement kilns is no longer a matter of choice; it is required by the demands for cements having definite qualities which cannot be produced without close control of burning conditions within the kiln and cooling of the clinker. Large buyers of cement have gone so far in their specifications as to require charts of kiln speed and burning zone temperatures, which are to be held within very narrow limits. The trend is increasingly in this direction.

In contrast to the former lack of interest in instrumentation are the modern practices and equipment as exemplified by the Leeds, Ala., plant

Two Leeds & Northrup Rayotubes, indicated by arrows, sight directly on the material inside two rotary kilns and relay temperature changes to Micromax recording instruments



[1] Argentina Cement Plant Uses Flotation Process, **Rock Products**, November, 1938, p. 24.

Recently developed Leeds & Northrup optical pyrometer to quickly check on all temperatures. Operator sights telescope on hot body, quickly adjusts the potentiometer measuring circuit and notes reading from temperature scale

of the Universal Atlas Cement Co. At this plant two control panels located on the kiln firing platform contain identical sets of meters, controllers, and motor switches for each clinkering unit. The principal instruments are as follows: Automatic—1. Kiln draft controller; 2. Coal feeder controller; 3. Cooler speed controller;—Recording—4. Radiation pyrometer on kiln-lining temperatures; 5. Pyrometers on kiln exit gas and secondary air temperatures; 6. Two-pen thermometer on air temperatures in and out of coal mill; 7. Kiln draft meter; 8. Secondary air-flow meter; 9. Two-pen coal mill pressure differential meter; 10. Kiln speed tachometer; 11. Kiln revolution counter; 12. Kiln feeder revolution counter; 13. Manometer on pressure under the primary cooler grate (indicating). Each panel is also equipped with manual control switches for all equipment in the system and indicating ammeters on all principal motors.

It was pointed out in connection with this plant that while kilns have been operated both at constant kiln speed, using small variations in firing rates to adjust for heat requirements, and at constant firing rates, using small variations in kiln speeds to correct for necessary heat requirements, the latter method was found best for dry-process kilns and the former method has advantages in wet kilns particularly from the standpoint of mud-ring formation, chain protection and material flow. The automatic control of draft, secondary air quantity and coal firing rate, plus the information furnished by the instruments, aid in obtaining more intelligent and economical operation.

More Automatic Controls

There is undoubtedly a definite trend to the use of more automatic controls in the cement industry as it is no longer possible to depend upon the human element where more or less rigid cement specifications are involved. While no statistics are available for the cement industry alone, industry in general showed an increase in automatic control types from less than 10 percent of the total in 1923 to nearly 35 percent in 1935.

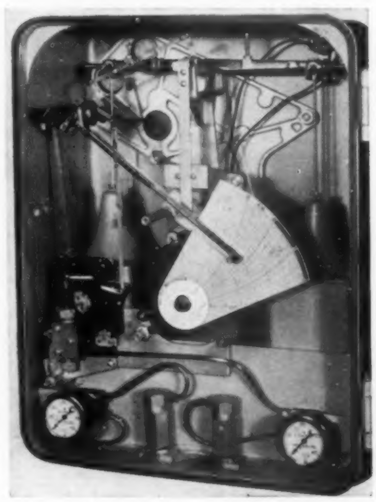
Fuel economy and uniformity of product are the two very desirable

Central control panel used in kiln operation. At extreme left is a kiln draft controller, and just below, the relay through which it actuates a motor drive to adjust damper. The central panel has an air-weight controller, with which are a kiln speed indicator and an ammeter. The Micromax at the top right is a two-point instrument which records temperatures of stack and secondary air. Below is a Micromax indicating controller which regulates the blending damper

ends gained by the use of instruments on kilns. As pointed out by William E. Reaser in Rock Products, January, 1939, p. 52, there are just two fundamental schemes of handling a rotary kiln and they are largely determined by whether the kiln is operating dry or wet process. These are: (1) to operate at a constant speed of kiln and vary the combustion rate; (2) to operate at as nearly a constant combustion rate as the firing equipment will permit, and vary the speed of the kiln to maintain required burning zone conditions.

In the first scheme, an apparatus to show continuously the condition of the exit gases is required so that when sufficient fuel is being fired to carry the load, the correct quantity of air is supplied to burn completely all the combustible without having too great an excess of air. An automatic gas analyzer, electrically operated, to indicate and record CO_2 and $CO+H_2$, has been used successfully, particularly on long kilns. However, no automatic feature has been applied to control the air supply. Another disadvantage is that when the fuel flow is changed, it is desirable to change the primary air flow in order that it remain as a constant percent of the total air required for combustion. This requirement is met by one type of unit coal mill having a special control. The automatic gas analyzer only shows whether or not there is sufficient total air to burn out the combustible. A two-point temperature apparatus has been successfully applied.

The second scheme of operation is more susceptible to automatic control. It is possible to apply apparatus to kilns to maintain automatically the necessary air flow and draft conditions, and then adjust the fuel flow until the desired combustion conditions prevail, as shown by a series of gas analyses taken by means of a hand Orsat. Once having determined the correct fuel flow-air flow relation required to burn the necessary quantity of material per hour, within certain limits as governed by the type of fuel feeding apparatus, it is possible to operate at this combustion rate and burn by varying the speed.

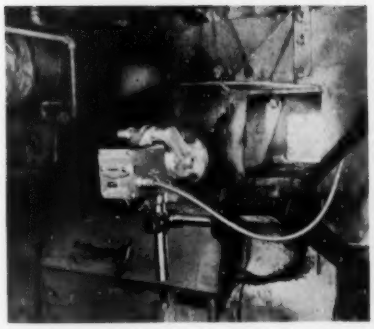


Apparatus inside Bailey hood draft recorder with the chart partially broken away to show mechanism

One of the first instruments used in the cement industry to improve burning conditions in the kiln was the Orsat analyzer for making CO_2 tests. This instrument was invaluable in checking up the percentage of CO_2 in the waste stack gases to determine whether there is excess air or an insufficient supply of air for efficient combustion. This hand instrument continues in use today but is now employed principally to check up CO_2 continuous recording instruments, which operate on the same principle. There is also an electrical CO_2 recorder which depends for its operation on the fact that CO_2 conducts heat only about 60 percent as well as air. If a heated wire is placed in the center of a cylindrical tube, the wire being kept heated by a constant current of electricity, the wire temperature would change markedly if CO_2 were placed in the tube instead of air. In other words, the CO_2 acts like a heat insulator applied to the wire. Since the electrical resistance of the wire is dependent on its temperature, the amount of CO_2 gas in the tube may be determined by measuring the resistance of the wire. There is also a mechanical type.

Kiln draft controllers are now considered indispensable. Draft control is applied at both the hood and the feed end of the kiln. In one type of automatic hood draft control, shown in the flow sheet, a recorder-controller is mounted at the firing end of the cement kiln and hood draft is transmitted to its actuating mechanism by a single pipe line. The recorder-controller responds to the slightest variations of draft in the hood, and by means of an air pilot valve it actuates the control drive which regulates the stack damper, or the uptake damper of the waste heat boiler, maintaining the hood draft at the desired value. A chart record gives a check on the operation of the control equipment and provides a daily graphic record of kiln performance. Compressed air at a pressure of 35 p.s.i. provides the motive power. As a supplement to the hood draft control, a draft recorder also is placed at the feed end. This recorder will reveal the formation of rings at an early stage. Where waste heat boilers are used, fluid meters, temperature recorders, and draft recorders are employed as operating guides.

Another type of kiln draft control comprises a controller, a relay and interrupter, and a drive unit. The controller has a balance beam with an oil-sealed pressure bell at each end. Through a small pipe, kiln pressure is brought to the inside of one bell while the second is at atmospheric pressure. Any variation in kiln draft causes the balance beam to tilt and close an electrical contact which causes the drive unit to readjust the damper. As kiln pressure is corrected, the beam returns to balance, the contact opens, and the drive unit stops.



Bristol's Ardometer applied to cement kiln for measuring temperature

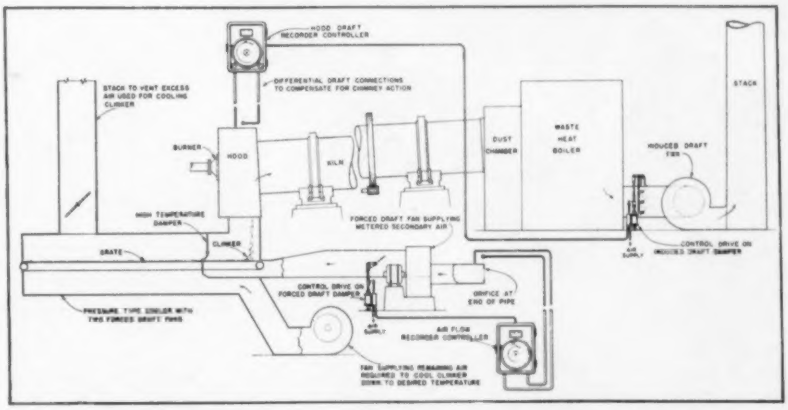


Diagram showing air flow and hood draft control (Bailey type) on rotary kiln equipped with a pressure type cooler and waste heat boiler

A third type of recording draft gage consists essentially of a slack leather diaphragm and a heat treated Beryllium copper cantilever spring attached to a pointer which is mounted on a pivot bearing. The diaphragm transmits the force of the draft or pressure to the flat spring which in turn moves the counterweighted pointer and produces a reading on the scale in direct proportion to the magnitude of the force.

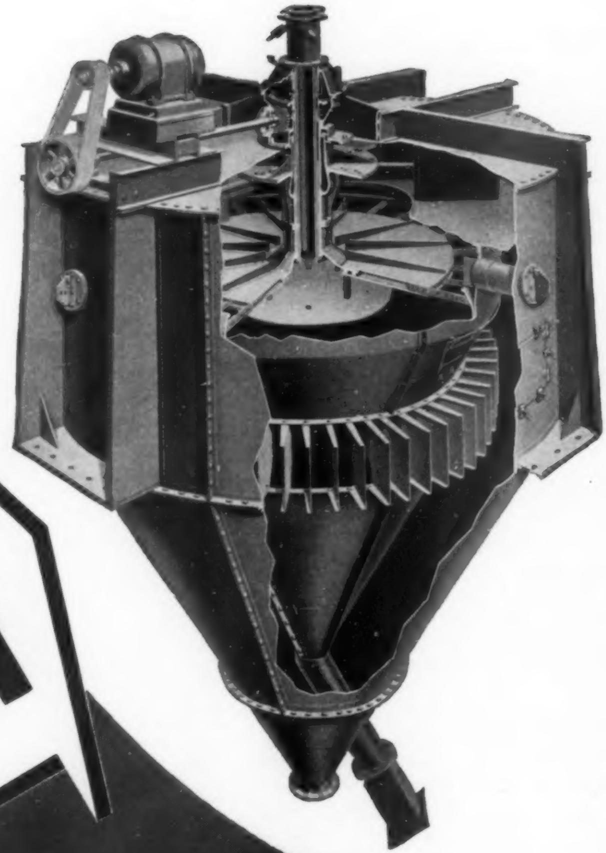
Various instruments have been designed to record continuously kiln lining or work temperatures and flue gas temperatures. One type has a temperature detector that simply sights through a hole in the kiln housing and onto the kiln lining. The data thus continuously detected is made available at any convenient spot by a recorder which can be equipped to operate signals or in some cases, automatic controls. Multipoint recorders also are available for recording flue gas temperatures at various points. Either detector tubes or thermocouples are used.

Radiation pyrometers of various types are employed to check temperatures at various points along the kiln. These hand-operated units permit a quick check on kiln temperatures with a great deal of accuracy. Radiation pyrometers are of two main types; those which measure the total energy of the whole spectrum of the radiation emitted by the hot body, generally called "total radiation" pyrometers; and those which measure the intensity of a monochromatic radiation or "optical" pyrometers.

Kiln speed recorders are used to give a continuous record of kiln revolutions and the rate of speed and may be arranged for manual or automatic control of kiln speed. One type is connected to an electric tachometer geared to some rotating part of the kiln. The tachometer generates a current which is continuously measured in the potentiometer circuit of a graphic recording meter.

Portable Orsat (Hays) analyses

DOUBLE WHIZZER *Air* SEPARATOR



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Science Applied To Control In The Quarry

By W. C. HANNA*

IT WAS WITH CONSIDERABLE RELUCTANCE that I accepted Mr. Rockwood's invitation to write a few words on this topic. It is no more than fair for me to contribute to ROCK PRODUCTS in return for what I have received from its pages, and the subject, although old, is so very important and neglected that a few lines suggesting problems for consideration may be worth reading.

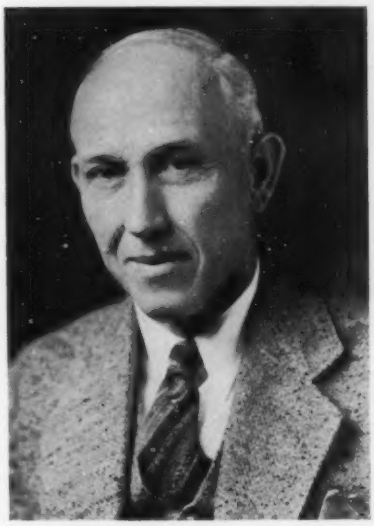
The trend in recent years for a number of different types of cements with limits on a number of components, as well as narrow limits on ratios, has made manufacturers study their supplies of raw materials more than in the past.

Quarries are the storehouses of the cement producers from which the chemist must select the proper limestones, shales, clays, etc., to make the products desired. It is needless to state that the supply of raw materials must be such that the laboratory may obtain the necessary grades at all times. The proper selection and use of these can only be done after the most intelligent survey of all conditions, for upon this depends not only the quality of the desired finished product, but the cost of the operation, and depletion of the raw materials. As words of caution, it must be said that the average chemical analyses of deposits are to be avoided unless they represent the material which can be consistently delivered.

Delivered Cost of Cement of First Importance

The manufacture of portland cements can be commercially accomplished only on a large scale, as prices obtained for them would not permit economical operation in small amounts. The raw materials should then exist in large quantities and the work in the quarries must call for the knowledge of chemical, civil, mining, mechanical, explosive, safety, and efficiency engineering, as well as geology. A man who is familiar with several of these branches of engineering is desirable.

Keeping in mind that the chemist must always have the necessary materials for the manufacture of the cements desired, we must then place the matter of delivered cost of each barrel at the top of the list of things to be considered. This could be stated, in part, as the price of raw materials, since it must also be kept as low as possible. It is necessary that about 600 lb. of usable material be produced for every barrel of cement of 376 lb.



W. C. Hanna

Keeping this cost down must not be for just a month or a year, but for the reasonable life of the plant, so all of the engineers who are to plan this work must have their views given very thoughtful analysis, their programs of operations well-understood at all times, and changed only after thorough deliberation.

Whether a quarry is already in operation or being selected for use, the same rules must govern operation, and these are:

1. There must be the proper raw materials in sufficient quantities to manufacture the desired products; either in the quarries or available through other additions or processing.

2. The cost of the delivered cement must be low enough to make the operation profitable.

These questions can only be answered after a most thorough report has been made on many branches of cement manufacture. The answering of nine questions which follow will help in arriving at the proper answer for the quarries.

Demands of the trade probably will alter methods of proper operation from time to time, and the development of new or improved machinery may also cause radical changes in plans which may have been most proper when made. The quarries must thus receive continuous study so as to obtain the best utilization of the raw materials at the lowest production cost.

Cements of any of the existing types can be made at any plant or proposed plant but to do this in a profitable way is a different matter.

Questions Concerning Quarry Operations

The chemical engineer must have a reasonably accurate knowledge of the limitations of the quarries from which the raw materials are obtained and these are some of the questions which he has before him all the time:

1. What kinds of cement can be made with the materials at hand? What are the limits in the chemical composition of cements that may possibly be obtained?

2. What amounts of the different kinds of cements can be manufactured and what are the probable future demands for each?

3. Will the production of these different grades make added operating expense by stripping, waste to dump, or very selective quarrying?

4. What materials must be brought to the plant from outside sources to make some of the special cements? Can a lower cost material be brought into the plant if certain parts of the quarry are wasted? Can a material of higher cost be brought in to advantage without added cost per barrel of produced cement if parts of the quarry were not used?

5. Can the quarried raw materials be processed or separated so as to improve them for the work to be done?

6. Can some of the quarry rock be

(Continued on page 53)

* Chief Chemist and Chemical Engineer, California Portland Cement Company, Colton, California.

How G-E equipment helps KEEP THE COST

Notes on our trip to the plant

G-E 4000-kw a-c turbine, which supplies power for the plant. This turbine utilizes the waste heat from the kilns. It has given practically trouble-free service since it was installed, 12 years ago

G-E 100-hp, Type FTR, 1765-rpm induction motor, controlled by G-E CR7006 magnetic switch, driving coal pulverizer. This is one of six such equipments in the plant—one for each kiln

G-E 350-hp, 257-rpm synchronous motor driving a compressor in the cement plant

ELECTRICAL MAINTENANCE ONLY

The Hawkeye Portland Cement Company operates a rock-crusher plant at Earlham, Iowa, which has been in operation for nine years. This plant is equipped throughout with G-E motors and control. There are 17 motors in all, with a total of 632.5 horsepower. Maintenance on *all* the electric equipment has averaged less than $30 a year—about 4 3/4 cents a horsepower. The company reports only anticipated minor servicing, and no shut-downs as a result of failure of the electric equipment. This with standard, open motors and standard control that operate in dust-filled atmospheres, sometimes for as long as 16 hours a day!

GENERAL

Hawkeye Portland Cement Co.

PER BARREL DOWN

THE Hawkeye Portland Cement Company produces high-grade cement at low cost in its six-kiln, G-E equipped throughout, wet-process plant at Des Moines, Iowa.

One reason is that the company has continued to keep its plant up-to-date. A year or two ago, for example, it installed coal pulverizers—each driven by a G-E 100-hp motor—for individual firing of the kilns. These pulverizers have markedly reduced coal-grinding costs and have practically eliminated coal wastage.

Another reason is the help that G-E engineers gave in revamping the plant's electrical system 12 years ago. This step proved to be of vital importance in enabling Hawkeye to meet modern production requirements.

These engineers showed the economies of changing from the d-c system then used to an a-c system and of replacing the old turbine-generator with a more efficient one that would give, at no increase in the capacity of the waste-heat boilers, the additional power needed to produce a higher-grade cement.

Hawkeye followed their recommendations. The plant has now been almost entirely changed over to a-c equipment, and the G-E 4000-kw turbine-generator, motors, control, and other G-E equipment have set a high standard for continuous operation and low maintenance.

This is another example of how many cement companies are benefitting from G-E engineering and equipment. Remember it when making your modernization plans. Our nearest representative will be glad to help you with the electrical requirements. General Electric, Schenectady, N. Y.

$30 A YEAR AT THE ROCK-CRUSHER PLANT

← G-E Type KT, 10-hp, 600-rpm induction motors driving roll grizzlies through reduction gear

→ G-E Type MT, 900-rpm, wound-rotor motors driving crushers

E L E C T R I C

011-512

How Many Cements Needed?

Brief analyses and discussion of the uses of the four types of portland cement now required in large quantities

By P. H. BATES*

DISREGARDING such hydraulic cements as slag cements, hydraulic limes, portland pozzolanas, high alumina, natural and slag-portland cements, all of which are available in our markets and hence must be "needed," attention will be directed in this presentation only to the cements of the portland type.

Four types of portland cement have been and are being produced in sufficient tonnage to indicate a steady extensive demand. They are as follows:

(*A*) *Regular Cement*: A type suitable where the demands of service, either in its early or later ages, will not be exacting. It might be (and has been) called an "all purpose" cement, but "all purpose" covers all possible uses and hence if it meets such qualifications there could be no reason for any other type.

(*B*) *High Early Strength Cement*: This, as the name indicates, is one which develops strength in the first day or two to a degree not attainable by any of the other types.

(*C*) *Low Heat Cement*: A hydraulic cement which in its reaction with water evolves approximately 15 to 35 percent less heat than types A and B, but possibly no less than type D. The heat expressed in calories per gram should not exceed 60 and 70 at 7 and 28 days, respectively.

(*D*) *Chemically Resistant Cement*: A cement which as a result of its composition (or processing) has distinctly better resistance to acids, both organic and inorganic, and to some of their salts, than any one of the three other types.

Type A Cements

In more detail, type A cements would include some of those now referred to as Standard cements, conforming to A.S.T.M. Standard C9-37 and Federal Specification SS-C-191a, provided they would meet the "unfortunate"** chemical limitations of the so-called "modified" portland cements, as required by Federal Specification SS-C-206 covering moderate heat cements. It should be understood from this that SS-C-191a would have to be withdrawn and SS-C-206 used in its place, and C9-37 be amended by adopting chemical limitations very similar to those of SS-C-206. Such procedures have already been anticipated by some producers and consumers. Some of the latter now very frequently use a cement of the modified or moderate heat type rather than the so-called "Standard" type. Some producers have also developed a cement which meets the chemical requirements of SS-C-206 and the physical requirements of C9-37 and SS-C-191a. Hence, since the chemical limitations of the two latter are so broad that most any percentage of the cement producing oxides is permissible, they have at hand a cement meeting all the requirements of these two old (to be dropped or amended) standards and the new proposed type A.

The specifications for type A cements would differ therefore from Specifications C9-37 and SS-C-191a in having limitations which will not allow the use of any percentage of SiO_2, Al_2O_3, and Fe_2O_3 that will give the required time of set, soundness and strength. Until satisfactory physical tests have been developed, a minimum of SiO_2 (21.0% suggested) must be exceeded; maximum limits for Al_2O_3 and Fe_2O_3 (6.0% suggested for each) must not be exceeded; the ratio of Al_2O_3 to Fe_2O_3 must be between 0.7 and 2.0 and the $3CaO.Al_2O_3$, calculated according to certain assumptions, must not exceed 8%.

The producer is fully justified in protesting such an extended use of chemical limitations and equally justified in believing that he should not be so restricted in the composition of his product. But he is also open to criticism for not having developed satisfactory tests indicative of the durability of his product. He should not leave the development of tests so much in the hands of the consumer. His is a continuing interest in cement, while the consumer very frequently has but a passing interest and one which frequently allows him the privilege of selecting another material which he may believe has no questionable future.

Type B Cements

At the present time the outstanding feature in the requirements of the cements of this type is that the strength at two or three days be about equal to the 28-day strength required of the present standard portland cement and the suggested Type A. There can be but little doubt that if this type gets into as wide a usage as the cements of type A, some tests predicting durability will surely follow. It would appear, therefore, that producers should be developing physical tests of this kind if they do not wish to be restricted by chemical limitations.

Type C Cements

Low heat cements are at the present time used where it is desirable that during setting and hardening the amount of the heat of reaction with water should not exceed specified limits. While generally they are used only in "mass concrete" (concrete of rather large sections), they lend themselves readily for use in any condition where high temperatures resulting from hardening are not wanted.

Specifications for this type of cement generally aim to secure low heat through chemical limitations alone. These are such that the percentage of silica is high, the lime low, and the alumina and iron oxide both low or present in such prescribed ratios that the caculated $3CaO.Al_2O_3$, assumed to be present, shall also be low (6 to 8%). Although it has been shown that "heat treatment" of the clinker or processing the clinker by different rates of cooling may also produce low heats of hardening, there has been but slight indication of permitting such practices. Hence,

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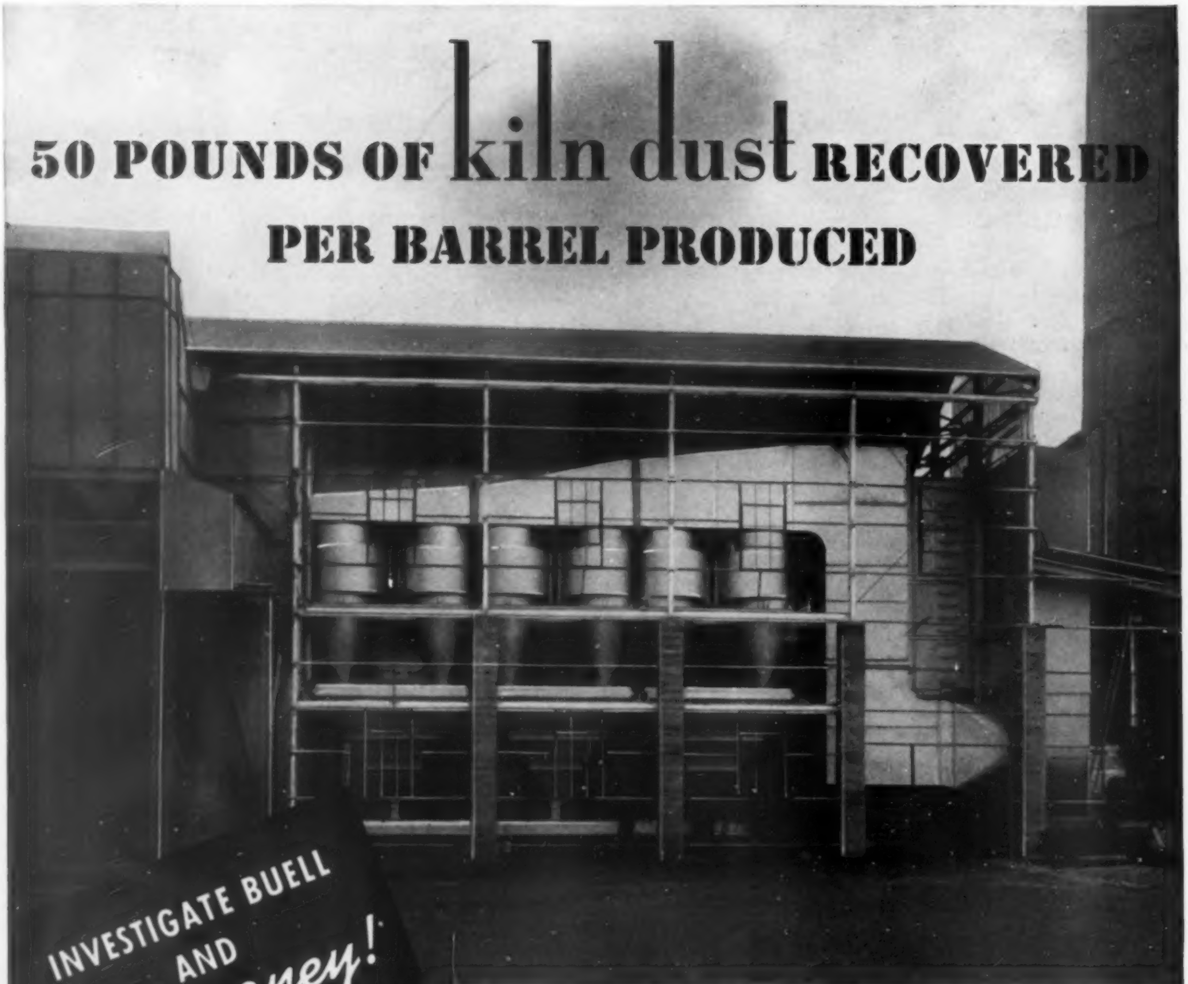
* Chief, Clay and Silicate Products Division, National Bureau of Standards, Washington, D. C.

** Unfortunate only because of our ignorance in not knowing of methods to predict the service of a cement, as evidenced by physical tests; and hence our having recourse to indicating what a cement should be, as evidenced by chemical limitations.



24 Buell (Van Tongeren System) Cyclones at the Kosmosdale, Kentucky, plant of Kosmos Portland Cement Company

Fifty pounds of kiln dust recovered every day for each barrel of cement produced! But that is only *part* of the story of economy and efficiency at this progressive plant.

The Kosmos Portland Cement Company is not only securing a high over-all collection efficiency. It is doing this at the lowest possible cost. It is writing off its investment in the shortest possible time.

The complete Buell Dust Collection plant will pay for itself in little more than three years. Thereafter the recovery will be practically a 100% net profit operation, for maintenance costs are so low as to be negligible.

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specifications do not place a maximum limit upon the measured heat of hardening, although this should be the case, but hope to secure the desired result through chemical limitations.

Type D Cements

The cements of this type are for use where they may be subjected to attack by such aggressive salts as those in sea water, the sulphate of soda and magnesia, etc., by inorganic acid, such as sulphuric, hydrochloric, etc., and by some organic acids, such as are produced by fermentation, etc. Under the assumption that of the compounds existing in cement those containing alumina are mostly attacked, both the Al_2O_3 and Fe_2O_3 must not exceed rather low limits (4% for each according to Federal Specification SS-C-211). Further, since in hardening of cement the higher the lime content the more hydrated lime (readily attacked by the aggressive agents) is formed, a rather high minimum silica content must be exceeded (24% in SS-C-211).

From the foregoing and the fact that the physical requirements are generally similar, it is evident that cements of types C and D may be identical. As an example, a cement produced by one of the mills for Boulder Dam had an approximate silica content of 26%; Al_2O_3, 2.0%, and Fe_2O_3, 1.5%. This mill is now producing this as a "sulphate resistant" (or class D) cement. It is to be regretted, however, that limitations of the chemical composition are being used to prescribe qualities without any adequate physical tests.

Resume

Briefly, in resumé, it is believed that four types of portland cement would fulfill all the present demands for such hydraulic cements. Also certain producers will be able to meet the requirements of the four types with three products. Further, it is believed that some producers favored with raw materials and well designed plants could make deliveries of all four types by grinding alone or by blending not more than two clinkers—as that required for the high early strength cement and that for the type D cement.

Finally, it is most unfortunate that it seems necessary to prescribe so closely the chemical composition of cements on the assumption that satisfactory service will be predicted thereby, rather than allowing the manufacturer to use any composition and such production methods as will assure this—subject to adequate physical tests.

Pozzolana Cements

(Continued from page 33)

and slow in acquiring their strength. Their virtues are that they go on acquiring strength indefinitely and are proved to be far more resistant to sea water and other corrosive waters than present-day portland cements. Ancient works prove they have a permanency that puts modern jobs of concrete to shame.

The present interest in pozzolana cements is significant in that it is evidence that we are turning at last from consideration of mere strength—often merely early strength—of portland cement concretes to the more important one of permanence of portland cement concretes. It is doubtful if a pozzolana cement made according to the definition given is by any means the last word in a cement for "concrete for permanence," but it should direct the attention of cement manufacturers, chemists and researchers to some of the elements that apparently make for permanence.

We even venture the guess that the day will come when much cement will be made by intimately mixing and grinding, or otherwise incorporating, some chemically very active form of silica with lime. We can get along without the alumina and iron. And, if we were starting a research campaign, we would study silica in all its phases rather than those baffling mixtures of varying amounts of lime, silica, alumina, iron oxide, etc. The inventor of an economically made, just plain calcium silicate cement would have the world by the tail!

Scientific Control In the Quarry

(Continued from page 47)

sold to advantage or used for other purposes without injury, or, on the other hand, disposed of at a profit in order to benefit the operation?

7. Should it be anticipated that in future years some of the outside materials will be higher in cost? In such a case should the quarries be operated so as to use much of these and thus be in a better position in future years? On the other hand, should the quarries be operated at the lowest possible cost for the present with the expectation that in future years the demands will not require some of the compositions now being specified?

8. Will the condition of the quarried materials or selected raw materials be of the desired physical condition for proper grinding and blending.

9. Will it be well to avoid the manufacture of some of the special cements?

Each of these questions could and should require scientific study. Any one of them could easily be the subject for a long paper, and the mere mentioning of them is all the present space will allow. Some of these have already been much discussed in published articles.

Typical of the modern methods of handling stone is the Bucyrus-Erie shovel loading into a truck with side dump body

Special Cements

Progress in the field of construction will demand constant research to supply cements that meet requirements of specific problems

By ALTON J. BLANK*

Ancient constructions utilized clays and other plastic binders as a mortar in which to seat building stones, as well as for filler purposes in the voids between the stones. When mixed with dried leaves, grass, sticks and other objects, clays also served as plasters on ceilings and protected inside walls.

Following this ancient period, the use of lime was resorted to, accidentally or otherwise, in the construction of dwellings, temples, aqueducts and other public works, and the use of lime in these as well as the more modern types of constructions has followed down through the ages. While a large portion of the edifices and other constructions now standing, utilized lime in the mortar employed in stone and brick work, as well as in plaster for inside and outside coats, during the past 20 years there has been a notable decrease in the consumption of lime for structural purposes, until at the present day the use of lime in this field has reached the lowest ebb in its history.

Concrete and masonry constructions in this period have departed from the older practices and methods due to improvements that have been made in the materials of construction and in the design of buildings, resulting from shifting populations and concentrated building areas, which necessitated a departure from the one and two-story buildings of thick foundations and walls to those of multiple-storied buildings designed to carry great loads and stresses.

Changed Construction Methods Increased Use of Cement

Where lime used with pozzolanic materials of natural and artificial origin composed the cemititious component entering into small and large constructions over a goodly number of centuries, the steps that eventually led up to the development of portland cement carried with it a complete change in the methods of construction. The entrance of portland cement into the concrete and masonry construction field was of a slow and experimental nature, and it was not until some 30 or 40 years later that portland cement made real competition for hydraulic and other types of limes.

Since the initial clays used in constructions were devoid of strength and contained high shrinkage factors, and as their uses were limited, the advent of the hydraulic and other types of limes resulted in the clays and binders being gradually pushed from the field. The limes, while possessing little strength, were plastic and not bothered with the shrinkage and expansion in the clays. Lime joints and plasters exposed to the action of the atmosphere, also hardened and formed a surface protection coat, which permitted the use of limes for exterior as well as interior work. While the erection of higher and larger buildings was permissible with lime, thick walls and arches were necessary in view of the fact that lime mortars inside the joints developed little or no strength with age, and acted simply as a bed or seat for the stone and brick.

Special Cements—Their Qualities and Uses

With the coming of portland cement, this product gradually replaced the use of lime in the heavier construction field. However, while portland cement contained great strength, which was not possessed by the earlier cementitious and noncementitious mortars, it did not contain the desired plasticity and workability in mortar and concrete, and to the present day an addition of lime hydrate to portland cement is necessary if plasticity, adhesion, impermeability and sand carrying capacity is to be had in a mortar, while in the concrete construction field the use of hydrated lime with portland cement is ofttimes specified, and necessary, if good working qualities in the concrete are desired.

However, the past ten years have shown a still further trend in the demand for special cements for use in specific types of concrete and masonry construction. Engineers and contractors who, in past years had accepted portland cement for use in all types of constructions, developed ideas of their own as to what a cementitious product should consist in for a given type of work, and rapidly discarded the view that portland cement constituted the only product for use in all-purpose constructions.

In the building of large dams in the middle West and other sections of the States, a number of new specifications covering cement made their appearance.

In massive concrete constructions, the heat of hydration of portland cements, causing alternate expansion and contraction and the setting up of stresses in the concrete mass, necessitated the utilization of cements of special design in which lower heats of hydration resulted. Specifications covering these cements limited the percentages of the tricalcium silicates and aluminates that could be present with the result that cements used in these constructions contained higher percentages of silica and iron and lower amounts of lime and alumina.

Other cements of a special nature made their appearance in various sections of the States, in Mexico, and elsewhere, and these high silica, pozzolan types of cements, found a ready acceptance in all types of concrete constructions which previously utilized portland cement. Some of these cements were found to be equal, if not superior to portland cements in general concrete constructions due to their progressive gain in strength, their lower heats of hydration, and their greater plasticity. In special types of concrete construction, such as those coming in contact with alkaline ground waters and sea waters, the special cements were found to be definitely more resistant to their destructive action. The fact that the special cements were of a stable nature, and not subject to high contraction and expansion, nor showed retrogression in strength at later ages, added much to their reputation.

In the masonry construction field, once utilizing clays, and later limes,

(Continued on page 61)

*Chemical Director, Cement Process Corp.

Fuel Selection - Testing

Survey of fuel selection and testing methods of cement companies indicates the need for more frequent and accurate analysis

By RALPH S. TORGERSON

WITH THE COST OF FUELS and purchased power representing nearly one-fifth[1] the total value of cement at the plants, the question of fuel economy is of vital concern to the industry. Approximately 5,200,000 tons of coal, 2,400,000 bbl. of oil, and 40 billion cubic feet of natural gas were required to produce 116,843,000 bbl. of cement clinker in 1937. Although oil and natural gas fuels have increased in use very materially, pulverized coal continues its dominant position as a fuel for the production of cement, representing 65 percent of the energy consumption.

To the credit of the cement industry, however, there has been a very marked increase in efficient use of fuels. Average consumption of coal, including equivalent purchased electricity, dropped from 189 lb. per barrel of cement in 1914 to 159 lb. in 1935, the largest portion of the savings being made in the years immediately following the war period. That there is still an opportunity for further improvements in fuel burning efficiency in many plants is shown by statistics. In 1931, for example, 42 percent of the cement produced at 98 coal-burning plants (accounting for 71 percent of the total portland cement output) was produced with a consumption of 110 to 129 lb. of coal per barrel of cement, but a few of the plants consumed less than 90 lb. per bbl. and a few others more than 200 lb. In that year 30 percent of the output came from plants that required 130 to 200 lb. of coal per barrel of cement, indicating the possibilities for increased efficiency.

Relative efficiencies of coal, oil and natural gas indicate one reason why there has been a shift to the use of oil and natural gas. Over a nine-year period, oil-burning plants showed the lowest average rate of fuel consumption per barrel of cement (118.2 lb. of coal equivalent); gas-burning plants had the highest consumption (143.6 lb.; and the average consumption of coal-burning plants was 132.3 lb. However, the selection of oil or natural gas for fuel is determined largely by the fact that the plants using these fuels are close to cheap sources of supply. For most plants pulverized coal will continue to be used as fuel.

Benefits of Better Selection and Analyses of Coal Purchases

A survey of the cement industry indicates that there is little uniformity in the methods of selecting and analysis of fuel purchased. In some cases the available economical supplies of fuel are limited which precludes anything like a rigid specification; in one case the coal is mined on the property along with the other materials essential to the manufacture of cement; and in other cases the sources of supply are so plentiful and close to the plant that certain mines are designated as meeting the required specifications. All these factors influence the methods of selection and testing of fuels.

In the case of oil and natural gas fuels, known sources of supply have practically no variation in chemical analyses. These fuels therefore do not present very much in the way of a problem, but there are many reasons why coal even from the same mine will show important changes in chemical analysis. Therefore, it is somewhat surprising to learn that some plants do not put emphasis on more frequent analysis of their coal supplies. The moisture factor alone is important as it costs money to dry coal below one percent moisture. Ash content of the coal may become troublesome. Richard K. Meade in his book, "Portland Cement"[2] points out that where there is considerable contamination of the clinker in the kiln it is necessary to balance the feed by adding more limestone. "The ash strikes the clinker and its velocity is stopped by the impact and it either falls among the clinkers or it sticks to the red hot, semi-pasty mass. It is probable that the coarser the coal the more ash will contaminate the clinker. It is an important point where this ash falls. If it falls before the raw material begins to ball up, 24 lb. extra limestone should be added to every 600 lb. of raw material to take care of the ash, as in this case, it would form Portland cement clinker. If, however, it falls on the clinker after it forms into balls, this quantity should be very much less, if any at all, as its action would then most likely be merely on the surface of the clinker to form a slag and not a true portland cement clinker."

While sulphur in the coal has no effect on the burning, except in large quantities, iron pyrites are hard and may not pulverize. The pyrites may remain in the coarse crystals after grinding and may fall from the nozzle of the burner among the clinkers without oxidizing. When ground with the clinker they cause the resulting cement to develop brown stains.

How Coal is Purchased

To show the variation in methods of selecting and testing coal, a survey was made of the cement industry's practices. Some of the answers to the questionnaire are as follows:

One large company operating seven plants advised, "We have never established any definite specifications for our coal. We do, however, endeavor to obtain a coal of as low ash, sulphur and moisture content as can be procured at prices favorable from an operating standpoint. Our plant chemists are continually analyzing all coal received and notify us of any running unusually high in the above elements. The average we try to maintain is about the following: volatile content, 36 percent; fixed carbon, 54 percent; ash, 7.5 percent; moisture, 1.5 percent, and sulphur, 1.0 percent."

A southern plant operator writes, "It has been our practice to purchase test cars from a number of the mines serving this area, make proximate analyses on samples from the test cars, observe the condition of the coal as received and its performance in our coal plant and in our kilns. The observations are not made in extreme detail but the analyses are carefully made. From the test cars we select coal to be bought in quantity and check its quality regularly through daily analyses on average samples of

daily analyses on average samples of the coal used daily. Generally we can tie these analyses fairly closely into the various coals purchased. When it appears that any one brand is dropping in value we investigate by again going to car samples. Incidentally, we have found that the difference in grindability is quite a factor with some coals." This company's practices are representative of the most careful analysis and selection of fuels.

Another company officer states, "Our coal is purchased on no set specification as we are located in the center of a coal-producing district, with 50 or more large or small mines within a radius of 25 miles of our plant. Our problem is to know the comparative heat value of all the coal produced in this district; to know their method of mining; to know their care in mining; to know the analysis of the ash content of the coal from these various mines; and then to select—depending upon the amount used and the capacity of the various mines—a group of these mines to supply us coal that will produce for us a uniform ash content of an ash analysis that will not upset our components, with an average B.t.u. value, and which will give us a reasonable consumption of coal per barrel of cement. If we were farther from the producing district and had a heavy freight rate per ton to pay, it would probably be advisable to buy on a strict specification."

A New York cement company advises, "We purchase nut and slack coal for our kilns on a size and mine specification, but we do not buy on a guaranteed analysis basis unless we are taking coal from a mine from which we have not previously had shipments. We depend upon the reliability of the source of supply, and our knowledge of the coals from the different fields in Ohio, Pennsylvania and West Virginia. Of course, the coal is sampled and analyses are run as a check on quality. We feel that the preparation of the coal is most important; washing or other cleaning, and the handling of machine cuttings in some mines, as well as the method of screening."

One of the largest cement companies in the country reports, "Our company has for many years had certain B.t.u. minimums, according to the location of the plant and the quality of coal available. A sample is taken from every car of coal received at our plants and when coal showing a B.t.u. content less than the minimum required by us is received, it is rejected. Our plants make regular monthly reports of all coal received, so we have a running record of the analyses of the coal purchased for our various plants."

Check Coal Carefully By Sampling All Cars

The purchasing agent of a large company with several plants writes, "All coal which the writer purchases is bought on the basis of a minimum volatile content and a maximum ash content. The coal is analyzed by our chemist to ascertain whether it meets with our specifications and these analyses are reported to the writer. In addition to this, we have the chemist observe the manner in which the coal performs during the burning period."

On the negative side of the question, one company operating two plants states very bluntly, "We do not purchase coal by specification." Another says, "Strictly speaking we do not purchase coal by specification, but all coal shipped is from specified mines and on delivery is checked for ash content, volatile matter and sulphur, all our kiln coal being purchased with the suitability of these three elements in mind. A far western company reports, "In purchasing coal, we insist that the coal meet certain requirements, but do not have rigid specifications and do not test each car as received." A southern plant official writes, "We do not consider this a practical way to buy coal because unless very broad limits on specifications are established, we do not know of any coal that could be bought satisfactorily in this manner."

By far the largest percentage of replies indicated that coal is purchased by specification and some have a very definite testing routine. Limited sources of supply in certain cases do not permit buying coal on specification, but even in these cases frequent analyses are made so that where there are variations in quality of the coal the kiln burner may make adjustments and the kiln feed may be changed to compensate for a higher ash content. Fuel costs could be substantially reduced by better methods of buying coal.

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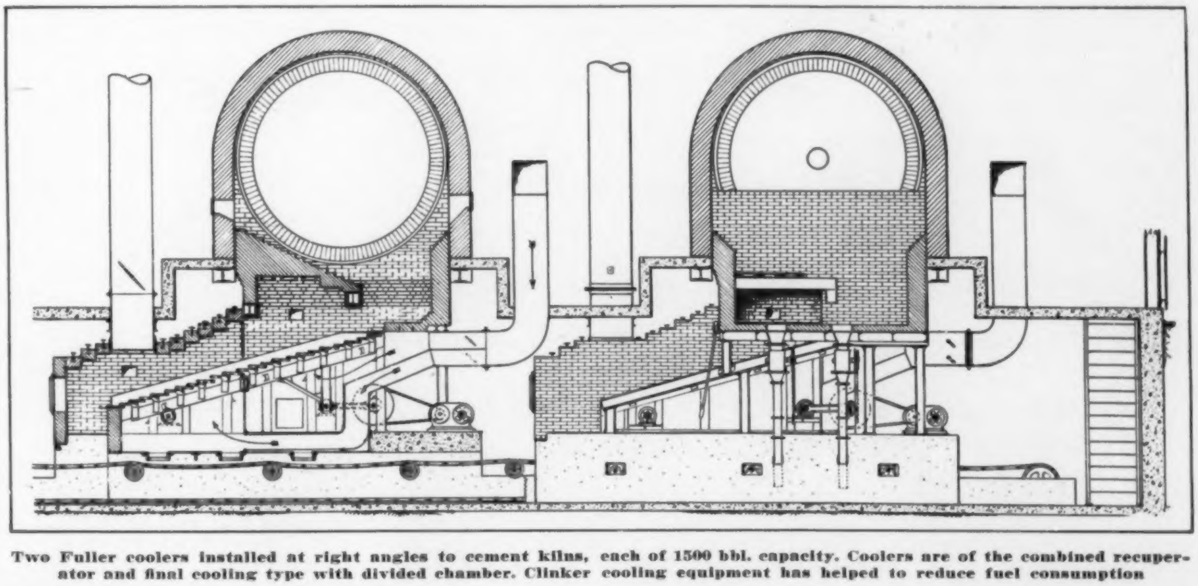
[1] **Fuel Efficiency in Cement Manufacture**, 1909-1935, WPA National Research Project and Bureau of Mines, pps. 9, 17, 60.

[2] **Portland Cement**, third edition, by Richard K. Meade, p. 281.



Two Fuller coolers installed at right angles to cement kilns, each of 1500 bbl. capacity. Coolers are of the combined recuperator and final cooling type with divided chamber. Clinker cooling equipment has helped to reduce fuel consumption

Special Cements

(Continued from page 55)

and of still later date, portland cement with lime, the demand for products having specific qualities, and the drawing up of specifications to cover these qualities, has resulted in the development of a great number of products of various designs and methods of fabrication.

Masonry cement for use as brick or stone mortar must now be extremely plastic, show good adhesion to brick or stone, stiffen up sufficiently rapid to permit of the cutting of clear joints in the mortar, and must not squash out between the brick. It also must have good water repellency and retention features, must not effloresce or stain or discolor, must have good sand carrying capacity, sufficient strength, and contain in general all of the properties and qualities desired of a product for this type of masonry construction.

When used as rough and finished plaster or stucco, the product must set up rapidly enough to permit the work to be carried out in ample time, and it must be devoid of shrinkage and expansion as well as free of impurities that would result in the staining or discoloration of the surface.

Manufacturers in the lime and cement industries, who formerly produced a standard product, now find it necessary to diversify their products in line with the demands that have been made for new and special products.

Clays had their day in the construction field for mortar and plaster work; limes relegated clays and other binders to the background and for centuries composed the main material for use in mortar constructions; in its turn portland cement became the foremost material for use in concrete and masonry constructions; and of more recent date, the consumption of which is steadily mounting, the special cements will have their inning, although lime and Portland cement will continue to be used.

In any field, progress moves along with the times. In the field of construction, and along with the development of new types of cementitious products, high buildings replaced low ones, concrete roads and dams replaced earth construction, pipes permitted the enclosed transportation of water and outmoded the use of open ditches; in fact, with each new development which has resulted in improved cementitious products, allied improvements have resulted.

ELECTRIFICATION
Speeds Up Cement Mill Improvements

Synchronous motors supplant old type induction motors for grinding. Improve drive on material handling motors.

By M. A. HYDE*

IN CONSIDERING THE PROGRESS made over the last few years in cement mill electrification these strictly electrical advances, important as they are, become far less impressive than the mechanical improvements which they usually bring about.

Consider first the grinding operations, where the major portion of the industry's power is applied. It has not been so many years since electric drive for the tube mills used in fine grinding commonly consisted of induction motors belted to large pulleys mounted on the mill pinion shafts. A row of such mills, Fig. 1, presented a formidable array of pulleys, belts, motors and starters, provided one could see it through the cloud of dust that accompanied its operation. This far-from-simple arrangement was fair in reliability, capable of considerable improvement as to economy, and a definite hazard to safety.

The low-speed synchronous motor provided a solution, being efficient, of high power factor and of construction suiting direct application to the mill pinion shaft, thereby eliminating belts. The torque deficiencies of this type of motor as built some years ago were surmounted by the use of magnetic or mechanical clutches; later these were built into the motor allowing the motor then to be directly coupled to the mill pinion shaft. Fig. 2 shows the same room as in Fig. 1 after low-speed synchronous motors had been installed.

Subsequently the electrical design of synchronous motors was improved so that no clutches were necessary, further simplifying the drive. In order to provide suitable accelerating action these motors have control arranged to increase the torque in successive steps during starting.

One of the most recent installations employs high-speed synchronous motors, which are physically smaller and inherently easier to build with high torques. These motors drive through reduction gears to the mill pinion shaft.

In cases where it is desired to limit the torque on the gears and mill, synchronous motors may be equipped with special control arranged to provide low initial torque, increasing the accelerating effect by suitable increments.

Great strides have been made in recent years by cement mill engineers in the simplification of process flow and by equipment designers in the production of efficient material handling equipment, particularly in the direction of minimizing loss of material during the handling. One of the most striking results of this progress has been the abatement of dust which formerly characterized cement mill operation.

Much of this conveying and elevating equipment requires power at relatively low input speeds, speeds far below those economically obtainable in conventional motor design. Not many years ago it was common to employ motors of commercial speeds, say 720 or 900 r.p.m., and transmit their power to the conveyor or elevator through a system of belting and open type gearing, speeds below 100 r.p.m. being common at the point of application of power. Fig. 3 shows an installation typical of this practice. Belt slippage and power loss through open gearing resulted in inefficient operation, the overall installation was not too good from the standpoint of reliability, and it constituted another hazard to operator

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Fig. 1: Before modernization program, induction motors were belted to tube mill pinion shafts in raw-grinding department

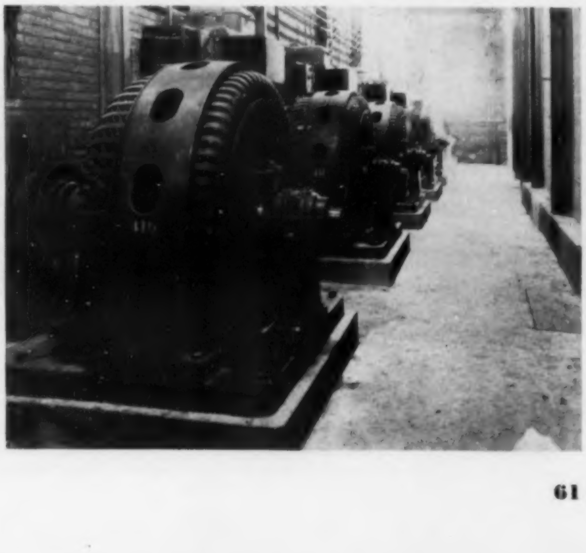


Fig. 2: Same room after installation of low-speed synchronous motors coupled to the mill pinion shafts

safety. Improvement in all these respects was made when this type of drive was replaced by enclosed silent chain operating in lubricating bath. Considerable further advance in space saving was made with the adoption of reduction gear units of the enclosed self lubricating types between the motor and the load. Such gear units, having tight enclosures, minimize the entrance of dust into the wearing parts, and when properly applied have proved an effective and economical means of power transmission.

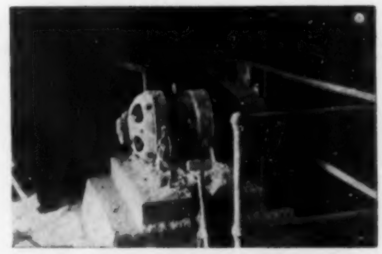
The greatest contribution to simple mechanical layout has been the development of the gearmotor which is a self contained drive consisting of a normally high speed motor and the necessary speed reducing mechanism combined into one unit. The gearmotor provides economical utilization of the slightly higher efficiencies and torques and the substantially higher power factor inherent in high speed motors, and at the same time provides reduction of motor speed to the exact requirement of the driven machine. These units are available in single, double, and triple reduction forms, providing standard gear ratios as high as 200 to 1. Horsepower ratings are available from ¾ to 75-hp., using standard motor speeds of 900, 1200, or 1800 r.p.m. One manufacturer provides 46 standard gear ratios with each of these motor speeds, giving output speeds that range from 4.4 r.p.m. to 1550 r.p.m.

Various types of motors may be employed in these units, including the polyphase induction squirrel cage motor of general-purpose characteristics, the same type of motor built for low starting current or high starting torque performance, also the wound rotor induction motor, the single phase motor and the direct current motor where conditions indicate the use of these less common forms.

Fig. 4 shows a belt conveyor installation operating indoors, having a 15 hp. unit with an output speed of 50 r.p.m. Although this foundation is of wood, it is very adequate because the unit construction of the gearmotor involves only one set of foundation bolts with no field work required to line up the motor and speed reducer or to maintain this alignment.

Compact Electric Shovel

An interesting application where space conservation is of primary importance is shown in Fig. 5. Here a 60 hp. unit powers all the motions on a 1¼-cu. yd. electric shovel used to load limestone into cars after it has been blasted from the working face in a mine. Although some of the rooms in this mine have 12- and 13-ft. ceilings in which the conventional electric shovel could operate, 11-ft. ceilings are sometimes encountered, requiring special design to produce an electric shovel sufficiently compact to operate in this confined space. It has previously been necessary to use shovels operated by compressed air. The use of the gearmotor resulted in the most compact electric shovel yet built, and one which permitted the loading of 30% more limestone than was possible with compressed air shovels.



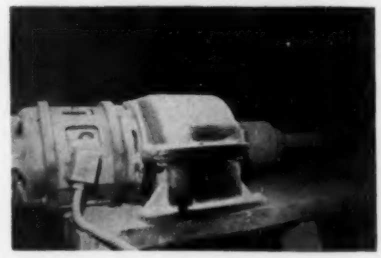


Fig. 3—Above: A 10-hp., 720 r.p.m. squirrel cage motor belted to a clinker conveyor, showing the old type flat-belt

Fig. 4—Below: Indoor installation of 15-hp., 50 r.p.m. gearmotor driving belt conveyor which is representative of the more modern trend

The advantages of compactness and mechanical simplicity have been realized not only in the development of various forms of motors, but also in recent progress that has been made in motor control equipment. Advances in motor design have produced motors of moderate starting current without sacrificing the other desirable operating features, and it is now general practice to build a squirrel cage motor suitable for starting directly on the line. This has greatly simplified the control required for such motors and has reduced the space requirement and cost. These factors, and improved practice in the laying out of power distribution systems, have resulted in the almost universal acceptance of full voltage starting, except on machines of largest capacity, in outlying locations, or on applications where it is desired to limit the starting torque of the motor in order to minimize strains on certain types of mechanical equipment.

A further improvement in modern control practice on circuits 550 volts and below is the extensive use of full voltage starters in which the disconnecting switch, ordinarily mounted separately from the starter, is combined in the same enclosure with the motor starter, giving a unit construction with one cabinet to install instead of separate enclosures for starter and disconnecting device.

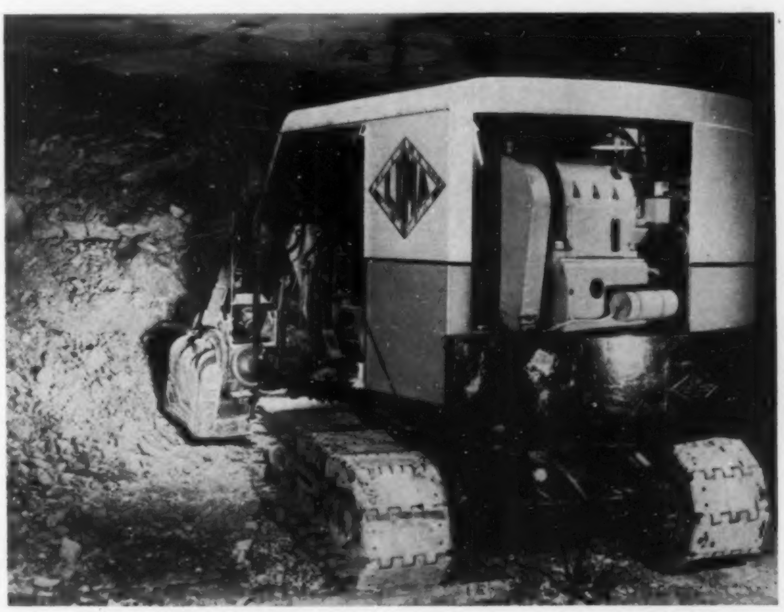


Fig. 5: A 60-hp. gearmotor effects vital space economy in an electric shovel operating in a low-ceiling limestone mine

Washing–Classifying Sand

Part 4.—A discussion of laws governing settling of sand in water and formulas for computing falling rate of velocities.

By EDMUND SHAW

SETTLING is the separation of granular materials from a current of liquid or gas in which they are suspended, by reducing the velocity of the current to a point where the materials are no longer held in suspension.

Settling is a natural process of much importance, geologically. The greater part of the land that supports dense populations was produced by settling. The Coastal Plain that begins in Central New Jersey and runs along the Atlantic Coast and around the Gulf Coast, and up the Mississippi Valley through the Delta region, was all made by settling. Mountains, now only a fraction of their former height, were disintegrated by weathering and the products carried by rivers to the sea. Here the velocity was checked so that the grains were not held in suspension, and they sank to form bars which became islands, which were later joined together by accretions and the action of the waves and the weather.

The great river valleys, like those of the Nile, the Yangtse Kiang, the Danube and the Mississippi, which support large populations, were formed by the settling of fine material brought in by flood water.

The settling of dusts carried by winds has also been important in forming great agricultural areas, for in this way the extensive loess plains of Central China were formed. So too were the rich lands of some parts of the Middle West, especially along the Missouri river.

Deposits of sand and gravel and the silica sand were all formed by settling. Sometimes they were settled and removed several times, in some cases by both wind and water, and the result has been a classification to a very uniform size of grain, as in certain silica sand deposits. Of greatest commercial importance in the United States are the fluvo-glacial deposits, formed by the settling of materials ground and broken from rocks by advancing glaciers and then carried by streams of water that came from the melting ice.

Formation of alluvial fans, a common effect of the slowing of streams carrying material, may be found in both the glaciated and unglaciated parts of the United States. It is interesting to study these because they illustrate so well the principles and the effects of settling. As the stream widened out the material deposited was finer. At the point where it debouches on the plain, the largest pieces were dropped, and they may be boulders of one-man-stone size and larger. Next there is a wider area covered with small boulders and cobbles, and then a still wider area covered with gravel. And as the fan still spreads out we see where the coarse and the fine sands have settled. Last of all to settle is the clay resulting from the grinding of the rocks through the action of the ice and the water.

Laws of Settling

It would be pleasant for the sand and gravel producers if they could discover perfect alluvial fans, because they would find the materials sized and sorted for them, needing only to be collected and sold. As we all know, however, no such perfect deposit exists. The plains do not increase uniformly in width and the flows are not uniform, the heavy spring rains pushing the material farthest on the deposit, often covering fine with coarse. One may even find a stratum of clay between strata of coarse materials. But every characteristic of the deposit is the result of settling according to fixed and well-known laws.

The laws which govern the settling of grains in water have been studied for many years, not only by metallurgists and others interested in them in a practical way but also by pure scientists. Sir Isaac Newton, whose mathematical work was the foundation of modern astronomy, did not disdain to leave his work on the planets to study the fall of minute grains in water and other liquids. But while the principles of settling are so well understood that we can design with confidence, it is by no means true that we have nothing more to learn about them. The settling of the finest particles still provides a field for investigation.

All settling, whether in a gas or in water, is dependent on two things, gravity and the viscosity of the liquid through which the grain is falling. In this series it will be assumed that all the settling is in water (unless otherwise stated) and the effect of variations in the specific gravity of the fluid will not be taken into account.

There are two ways by which the liquid affects the fall of grains: simple friction and resistance to shear, and the formation of eddies. With small grains there is little or no eddy forming effect, but a great deal of friction, owing to the great exposure of surface. A 1-in. cube exposes only 6 sq. in. of surface, but if it is cut into cubes of 1/16-in. on the edge the exposed surface is 96 sq. in., and with the smallest grains with which we have to deal the exposed surface is hundreds of square inches, compared with the surface of a 1-in. cube.

With the large grains the effect of friction is small, but the resistance due to eddy currents is large. The larger the pieces the greater the effect of eddy currents, or wave forming. Designers of water craft find the wave forming resistance much more important than the resistance due to skin friction.

Grains fall at a constant rate in a liquid and not with increasing velocity as in air. This is because the pull of gravity and the resistance of eddy forming and friction are in balance.

Formulas for eddy current resistance have been worked out. That of Allen (quoted from Taggert*) is $R = Kpa^2v^2$ in which p is the sp.gr. of the fluid, v is the velocity of fall

* Handbook of Ore Dressing, Arthur F. Taggert, John Wiley & Sons, Inc.

and a the radius of the particle, assumed to be a sphere, and K is a constant. This gives the resistance in c.g.s. units, but for designing we need the velocity. This, according to Taggert, is found to be, $v = C\left(D\frac{(s-p)}{p}\right)^{\frac{1}{2}}$ in which D is the diameter of the (spherical) particle and C equals $\left(\frac{2\pi g}{3K}\right)^{\frac{1}{2}}$; s is the specific gravity of the mineral. The method, obtained by equating the value of the eddy resistance (found by Allen's formula), to the gravitational pull on a failing body, is given in Taggert's *Handbook of Ore Dressing*, p. 551.

Prof. Richards investigated the fall of mineral grains in water more than 30 years ago, and his work is still considered authoritative. By plotting the curves of his falling rates for quartz the value of C was found and the equation was written as, $v = 92(D(s-1))^{\frac{1}{2}}$. This applies only to the coarsest particles which would be classified, from 1½ mm. to 10 mm. diameter.

This is Richards general equation for the fall of particles in water, $v\ K(D(s-1))^{\frac{1}{2}}$ with 92 as the value of the constant K, for quartz.

Prof. Truscott of the Royal School of Mines, author of *Ore Dressing*, has worked out formulas for eddy current resistance and velocity that check reasonably well the work just given. His eddy current resistance formula is:

$$R = 0.5\,\frac{\pi D^2}{4} \cdot \frac{v^2}{29}\,s\,w.$$

If D, the diameter of the grain, and v, the velocity, are in mm. this works out to $v = 112\sqrt{D}$.

Assuming that D is 4 mm. in both cases, by the above formula, v, the velocity is 224 mm. per second. By Taggert's formula it is 235 mm. per second. The difference is much less than that which might be due to different shapes of grain.

The finest grains with which we have to deal in classification fall according to Stokes' law, already referred to in the first part. This has been simplified by Taggert to $v = 450D^2\ (s-1)$. For quartz fragments in this range Truscott has this formula, $v = 700\ D^2$. For quartz, Taggert's formula would be $v = 450\ D^2\ (2.64-1)$ or $738\ D^2$. The difference is only 5%.

Between the finest and the coarsest grains lie those to which neither formula applies, as the resistance met with is due to both friction and eddy currents in something like equal degree. For these grains Taggert finds the fall to be according to this, $v = 95\ D^{0.83}$.

For grains in this range Truscott uses Richard's general formula with the value of the constant 87 for quartz. This does not check quite so well as the others. For a 1 mm. grain the fall would be 95 mm. per second according to Taggert's formula and 111 mm. according to Truscott's. In tabular form, the formulas and their range is,

RANGE OF FALLING RATE VELOCITY FORMULAS

Grain Size, mm......	0	.295	.295	1.651	1.651	9.423
Screen No's.	—200	No. 50	No. 50	No. 10	No. 10	No. 2
Taggert's Formula ..	$v = 450D^2(s-1)$		$v = 95D^{0.83}$		$v = 92(D(s-1))^{\frac{1}{2}}$	
Truscott's Formula ..	$v = 700D^2$		$v = 87\sqrt{D\ (s-1)}$		$v = 112\sqrt{D}$	

The following table gives the falling rate velocities of grains in the above ranges. The velocities were figured independently and checked with Taggert's tables. The column marked "Richard's" gives the velocities found experimentally by Prof. Richards and published in the 1906 edition of *Ore Dressing*.

VELOCITIES OF FALL COMPUTED FROM FORMULAS

Screen Number	Dia. in mm.	Velocity mm./sec.	Richards Observations	Velocity in./sec.*
No. 2	9.423	362		14.4
3	6.680	305	295	12.2
4	4.699	256	250	10.3
6	3.327	216		8.6
8	2.362	182	166	7.3
10	1.651	152		6.1
14	1.168	108	106	4.3
20	.833	82		3.3
28	.589	61	60	2.4
35	.417	46		1.7
48	.295	34.5	34	1.4
65	.209	25.8		1.0
80	.175	22.4		.90
100	.147	16.0	12.5	.64
120	.124	11.4		.45
140	.104	8.02		.32
170	.088	5.74		.23
200	.074	4.06	3.0	.16

The reader may ask what advantage there is in using formulas to find the falling velocities of grains. The best reason for using them is that they are definite and there is a tendency among some engineers to use diameters of grains instead of the corresponding sieve openings. For example, we speak of 20 mesh grains. One way of interpreting this is that it means grains passing 20 mesh and retained on 28 mesh. But one who was in the habit of testing with a nest of sieves and speaking of 20 mesh as that which was retained on the 20 mesh sieve would have an altogether different idea. And many persons think of 20 mesh grains as those which are of the diameter of the opening of a 20 mesh sieve. By the first interpretation the grains would average .711 mm. dia.; by the second, 1.00 mm.; and by the third, .833 mm. The velocities of crushed quartz grains for these diameters would be 72, 95 and 82 mm./sec. The fastest is 1.3 times the slowest in falling, and the difference is enough to affect design.

In testing with a 20 mesh sieve, opening .833 mm., all grains either pass or are retained, so there are no grains of .833 dia. What we need for design is the average falling rate of the grains between two sieves, as between 20 and 14, or between 20 and 28 mesh. We want the falling velocity not of a size but of a size-group. For practical purposes we may suppose the average to be the falling rate of a grain that has a diameter of half the sum of the sieve openings; although some experiments tend to show that it should be a little larger, half the sum of the diameters plus 60% of the difference between them. But the difference does not seem important with silicious grains, although it might be so with heavy minerals.

The formula which has the greatest use in designing settlers and classifiers for sand is that which applies to grains passing 10 mesh and remaining on 100 mesh, $v = C\ D^{0.83}$. Assuming that what is desired is the velocity of grains between 20 and 28 mesh sieves, and that the material is natural river sand, the work is as follows: Given, D equals .711; C (for river sand) is 137. Then,

Log of .711 equals	9.8513 — 10	
Multiplying by .83	.83	
	295539 — 8.3	
	7.88104	
	8.176579 — 8.3	
Adding and subtracting 1.7	1.7	1.7
	9.876579 — 10	
Which is log of .753 or $D^{.83}$		
Adding log 137	2.1367	
	12.013279 — 10	

Which is 2.013279, log of 103.1 the velocity in mm./sec.

(To be continued)

* One inch is taken as 25 mm. in this table and those that follow.

Test Methods Under Scrutiny At The A.S.T.M. Annual Meeting

Studies of concrete and aggregates point to need for more information on service qualities of materials

By NATHAN C. ROCKWOOD
Mem., A. S. T. M.

A TRIP through the exhibit at the recent annual meeting of the American Society for Testing Materials would certainly have impressed the average producer or manufacturer of rock products, as it did me, with the fact that the art and science of testing materials have certainly grown as fast if not faster than the art and science of their manufacture. Without questioning that many improved properties of materials have been developed because of new means to prove them, we sometimes wonder if other desirable attributes in the product are not lost sight of in the enthusiasm to develop tests which sometimes seem rather remotely related to those attributes.

Frank M. Welch, manufacturer of a Los Angeles rattler, admires the model of his device

Freezing and Thawing

A case in point is the attempt to develop a test for weather and time resistance of materials by subjecting them to cycles of artificial freezing and thawing. One whole afternoon's session of the convention was devoted to this subject with C. H. Sholer, of the Portland Cement Association, as chairman and Stanton Walker, of the National Sand and Gravel Association, as secretary. There were few prepared papers and much extemporaneous discussion based largely on experience.

It seemed to us that the only conclusion one could draw—that is one who was more interested in the materials tested than in the method of test—was that, as at present conducted, there are so many variables in the freezing and thawing test that various and diverse conclusions can generally be drawn from the results. For example, the session included a summary of a paper by Gerald Pickett, Kansas State College, on "The Effect of Biot's Modulus on Transient Thermal Stresses in Concrete Cylinders." The paper is highly mathematical and technical and we leave a digest of it to those interested; but this much any one could understand; there are very appreciable stresses in concrete caused by unequal changes in temperature.

Freezing and thawing tests not only develop these stresses and show their disintegrating effects, but also in some measure show the effect of the growth of ice crystals in the pores of the material. Therefore it makes a lot of difference how low the temperature goes, whether the specimens are thawed in air or under water, how fast are the cycles of freezing and thawing, how thoroughly saturated is the specimen, etc. And when you get all through the question arises as to how nearly the test conditions fit natural conditions where concrete or other structural materials are seldom if ever saturated when frozen and thawed.

For permanency of concrete pavements one man strenuously advocates dense impermeable concrete, another is striving to develop a porous one which will provide cells where the ice crystals can expand without disrupting the material. And what the real testing engineers are aiming at is a standardization of freezing and thawing tests which will give concordant results! To cap the climax the chairman, who was a professor at Kansas State College, said, probably somewhat facetiously, that his first concrete pavement was his best; and that result was accidental. He did say in all seriousness that it would have been better to go back and to have found out the reasons for these good results rather than to have spent so much time devising new ways to find shortcomings in the materials.

Another example which would make it appear that those having to do with rock products are becoming more practically minded was the failure of the convention to accept the proposed tentative method of test for autoclave expansion of portland cement. The vote in committee C-1 on recommending it to the society was nearly evenly divided, 24 to 22, and when the report came before the convention the autoclave test failed of adoption, which would have required a two-thirds vote. The rest of committee C-1's report was adopted entire. This contained nothing very startling. The final setting time in the standard specification for high early strength portland cement was dropped. A revised method of determining specific gravity of cement was adopted.

The reason the autoclave test met with considerable resistance appears to be that an influential number of members are not at all convinced of its conclusiveness. A case was quoted where a cement had passed the test beautifully but briquettes stored in fresh water had disintegrated in a year, for some as yet unexplained reason. That the test is helpful as a method of control of manufacture was universally agreed.

Two Ph.D's who frequently disagree—F. O. Anderegg and J. R. Withrow

Masonry Mortar "Primer" Returned to Committee

The preprinted report of committee C-12 on mortars for unit masonry (J. W. McBurney, chairman) included a "Primer on Specifications and Tests for Masonry Mortar." This consists of a series of questions and answers which very much aroused the ire of

the members of the society who are interested in the manufacture and use of lime. According to their point of view the "primer" put altogether too much emphasis on strength of mortar and masonry walls and not enough on water-proofness, or leak-

P. L. Rogers, Riverton Lime and Stone Co., and W. W. Brumbaugh, National Lime Association

age resistance. The committee chairman reported to the convention that the "primer" and the accompanying specification had been withdrawn by vote of the committee for further study, after having been accepted by previous letter ballot.

Lime Committee's New Members

Dr. J. R. Withrow, chairman of committee C-7 on lime, announced the election of five new members of the committee as follows: Kermit Herndon, Ohio State University; F. S. Pritchett, Delaware Testing Laboratories; H. C. Plummer, Structural Clay Products Institute; W. C. Voss, Massachusetts Institute of Technology; H. H. Waples, Procurement Division, U. S. Treasury Department. The committee is still struggling to find a comprehensive definition for "lime."

Concrete and Aggregates

The committee C-9 report on concrete and concrete aggregates contains many revisions of test details and an extensive appendix of methods of tests proposed. Probably the one of these of most general interest is that by Ira Paul, associate laboratory engineer, New York State Department of Public Works, on a "New Laboratory Method for Determining the Organic Matter in Fine Aggregates." The method involves the use of an apparatus for determining the pH value of samples—a method familiar to agricultural lime and limestone producers, since this is the scientific method of determining soil acidity. Mr. Paul takes advantage of the fact that organic impurities in fine aggregate form acids which are detectable by this means.

Committee C-11 on gypsum has written a new section for its standard methods of testing gypsum and gypsum products to cover the determination of wood fiber content in wood-fibered gypsum plaster. The specification calls for not less than 1 percent by weight of fiber, but no standard method existed for determination of the amount.

Sieve Tests of Mineral Fillers

The report of Committee D-4 on road and paving materials contains a comprehensive report on "Coöperative Tests for Sieve Analysis of Mineral Fillers" (Sub-Committee B-9). The conclusion drawn from these sieve tests is: "From the results obtained it appears that a reasonable value for agreement between different laboratories is 2.0 percent for the No. 200 sieve. The reported values for the No. 80 sieve show a much better

Two well-known chemists of the lime industry: J. A. Murray and A. H. Nieman

agreement." Included in the report is a proposed method of test for sieve analysis of mineral fillers.

Crushing of Aggregates Under Road Roller

A paper of considerable significance to producers was that of Tilton E. Shelburne, research engineer, Joint Highway Research Project, Purdue University, on "Degradation of Aggregates Under Road Rollers." Among the conclusions drawn from tests were these: (1) Different types of aggregates from various sources showed a difference in their resistance to crushing under the 10-ton roller; (2) the order of rating the aggregates from these roller tests was approximately the same as that obtained from the Los Angeles abrasion tests; (3) with seven round trips of the 10-ton roller, approximately 1.3 times as much degradation was produced with crushed gravel as with uncrushed gravel; (4) the cumulative grading of the aggregates after 100 revolutions in the Los Angeles rattler was very similar to that after seven round trips under the rear rollers on the rigid base; (5) a fairly good correlation was found to exist between the loss after 100 revolutions in the rattler and seven round trips of a 10-ton roller on a rigid base. Which all means, we presume, that the Los Angeles rattler is a practical testing device.

In connection with a study to determine causes of deterioration of concrete, T. F. Wills and M. E. De Reus, Missouri State Highway Department, investigated "Thermal Volume Change and Elasticity of Aggregates and Their Effect on Concrete." Tests on the two principal types of coarse aggregate used in Missouri, limestone and chert, showed: (1) the thermal coefficient of expansion of limestone is materially smaller than that of chert; (2) the modulus of elasticity of both limestone and chert is highly variable, even for material from the same source, but, in general, the modulus of limestone from any one deposit is more uniform and considerably smaller than the modulus of the preponderance of the chert from any single source; (3) the thermal coefficient of the sand is one of the principal determinants of the thermal coefficient of a mortar made from it.

Aggregates Judged By Service Records

Another paper of very practical significance to the producers involved was "Selection of Aggregates for Con-

Secretary of lime committee, C-7, J. W. Stockett, talking to J. R. Withrow, chairman. In the center, facing the camera, is E. E. Eakins, vice-chairman of the committee

crete Pavement Based on Service Records," by Curtis Cantrill and Louis Campbell, Kentucky Department of Highways. The purpose of the investigation was to determine: (1) aggregates having unsatisfactory service records, and (2) standard tests which would eliminate future use of such aggregates.

The summary of the paper states: "Examination of the concrete in which certain aggregates were incorporated showed that a large decrease in flexural strength had occurred. This condition was especially notice-

able in chert gravel pavement after a period of exposure varying from 2 to 5 years. Flexural tests on laboratory specimens made from chert gravel and subjected to 40 cycles of freezing and thawing in the presence of water substantiated this observation. A decrease in flexural strength as high as 100 percent was observed for specimens containing chert gravel obtained from the Tennessee River, 15 miles above its mouth. Chert gravel from the Cumberland River at Clarksville, Tenn., showed results slightly better. This material has successfully passed all standard tests for soundness and wear. Field specimens of chert gravel concrete have always passed the usual strength requirements. This investigation indicates that failure and disintegration of concrete pavement throughout the western part of the state resulted from the use of chert gravel obtained from the Tennessee and Cumberland Rivers, and that the fine aggregate did not contribute to this failure. Crushed sandstone resulted in satisfactory pavement when used with Ohio River sand, whereas when used with sand made from sandstone it resulted in unsatisfactory pavement." The Cumberland and Tennessee River sands were all right when used with Ohio River gravel or limestone.

Effect of Cement Content and Fineness

Ernest Gruenwald, engineer, Incor division, Lone Star Cement Corp., gave a resumé of a study of "The Effect of Cement Content, Cement Fineness, on Compressive Strength, Durability, and Volume Change, of Concrete." There were a great many conclusions, among them these: (1) plain concrete mixes containing less than 4 bags of cement were deficient in plasticizing material and therefore lacked true workability; workability of these mixes was improved by adding either cement or inert filler; (2) the 7-day strengths produced by the 1745 cm.^{2} specific surface portland cement were about 300 p.s.i. higher for the same water cement ratios than 28-day strengths of cement twenty years ago; (3) increased cement fineness improved workability but was ineffective in mixes containing less than 3½ bags; (4) increase in fineness was accompanied by an increase in compressive strength at early ages up to 7 days; at 28 days and 3 months, fineness was less effective in improving strength; (5) high-early-strength cements gave substantially greater strengths up to 7 days than portland cement of equal fineness; (6) high-early-strength cement produced the least difference between air-cured and moist-cured strengths, indicating greater curing efficiency for high-early-strength cement; (7) for mixes of the same cement content, the finer cements produced concrete of somewhat greater durability (tested by freezing and thawing); (8) as fineness of cement increased, shrinkage decreased for 2-in. slump concrete, but increased for 6-in. slump concrete.

There is a wealth of other data in this paper, but enough has been quoted to show that it makes a pretty good case for finely ground cements.

Other papers were primarily of interest to testing engineers, and reference to them is omitted in this brief summary.

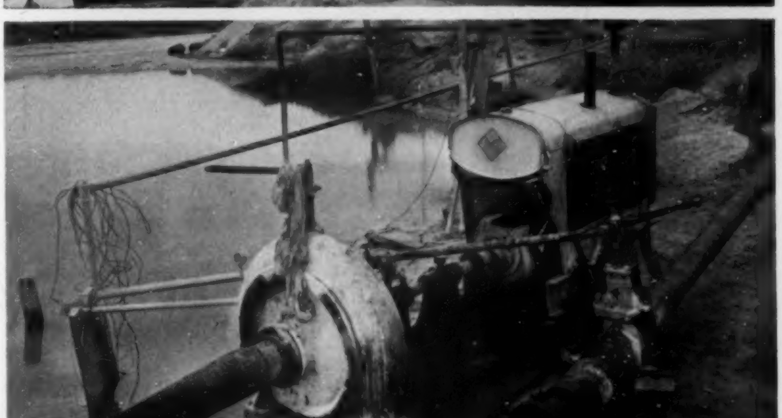
Transfer Pump From Land to Dredge

LAKE WALES INDEPENDENT SAND CO., Lake Wales, Fla., recently converted a land sand pumping station for service on a dredge. In the accompanying illustrations are shown a 6-in. Georgia Iron Works pump powered by a direct-connected Allis-Chalmers U-40 type gasoline engine. This pumping unit has now been transferred to a dredge boat which will increase the radius of operations. The pump discharges over gravity screens in the flume following the discharge box, and fine sand is recovered in a 72-in. Link-Belt cone, loading directly into cars. Capacity of the plant is between 300 and 400 tons in 10 hr.

Rapid Progress Made On Rock Island Gravel Plant

THE ROCK ISLAND SAND AND GRAVEL Co., Rock Island, Ill., is making rapid progress in the construction of its new plant located at Green Lakes, north of the Milan-Andalusia road. Eventually all of the 75-acre tract will be stripped, but only a small portion of the overburden has now been removed with Le Tourneau Carryall scrapers and Caterpillar tractor. There are five reinforced concrete storage silos with seven bins. Material will be pumped by dredge into a sump, from which it will be conveyed by bucket elevator to a vibrating screen which serves as a dewaterer. The gravel is carried by belt conveyor to the center bin, over which there will be sizing screens to separate the various gradations and chute them to the seven bins. Sand and gravel will be taken from the bins by gravity to a reclaiming tunnel conveyor and then moved to a second blending plant to produce any desired specification.

Above: Plant of the Lake Wales Independent Sand Co., Lake Wales, Fla. Below: Gas engine direct-connected to 6-in. sand pump which has been transferred to dredge boat



Rapid Chemical Analyses

Method for routine analysis of limestone, cement raw mix, cement clinker, and cement where speed and accuracy are essential

By GEORGE P. HORN, L. E. HETRICK, and J. P. McAULIFFE, JR.*

TO FACILITATE routine oxide analysis of limestone, cement raw mix, cement clinker, and cement, where both speed and accuracy are essential to maintain production schedules, a rapid method has been developed which compares favorably in accuracy with both Federal and A.S.T.M. analytical procedures. The method is simple in operation, requiring fewer manipulations than methods now generally in use. Ammonium chloride is used to separate the silica from iron and aluminum oxides in silicates decomposable by acids. Results of this method are cited and compared with results of Federal Procedure SS-C-158 and the standard A.S.T.M. designations C 114-34T.

In routine control analyses in the cement industry it is necessary to determine the oxide analysis of raw materials, clinker, and cement in a limited time. It is evident that often the tedious double evaporation for separation of silica, iron, and alumina is too lengthy to be of value to the analyst. A quick method, therefore, which is at the same time dependable and simply manipulated, would be of great value to the control laboratory. Numerous rapid methods are in use in various laboratories, giving fairly satisfactory results. However, with varying amounts of iron and alumina, some of these rapid methods are difficult to duplicate consistently. This work was undertaken with a view to developing a rapid method applicable to materials containing higher iron, alumina, and silica than the standard portland cement mixes. In using the perchloric acid method of analysis, it was observed that in the case of samples high in iron, the silica and R_2O_3 vary with the length of time evaporated, and with the degree of heat used in the evaporation. Identical samples, when subjected to more or less baking than usual, had different contents of silica and R_2O_3. A method was sought which would eliminate this possibility of error.

A review of the literature shows that numerous investigators have used ammonium chloride in analyzing silicates decomposable by acids, with surprisingly accurate results. Barta (R. Barta, "Materiaux construction trav. publics," 166, 156, 1923), Zaitzev, (M. I. Zaitzev, "Zavodskaya Lab.," 3, 492-494, 1934) and others have published papers relative to the use of ammonium chloride in this manner. Maczkowske (E. E. Maczkowske, Cement Mill Section of "Concrete," 144, 45, 3, March, 1937) has outlined a method for the determination of silica in portland cement using ammonium chloride. Utilizing the work of these investigators, this laboratory has obtained a rapid method for the analysis of limestone, cement raw mix, cement clinker, and cement. The procedure gives results which compare favorably in accuracy with the results obtained by use of the procedures outlined in Federal Specification SS-C-158, and the A.S.T.M. Designation C 114-34T.

CHEMIST'S CORNER

Problems and practices of the chemists in the industry are discussed on these pages. Contributions and comments are invited.

If the sample under consideration is limestone or cement raw slurry, weigh 0.5 g. of the finely ground sample into a large platinum crucible provided with a cover, and heat strongly over a Meker blast burner for three to five minutes. After thus decomposing the silicates, transfer the mass to a 50 ml. Pyrex beaker and reduce the lumps to dust with the flattened end of a glass rod. Thoroughly mix the sample with approximately the same weight of C.P. ammonium chloride, free from lumps, and add cautiously 5 ml. of conc. HCl (sp. gr. 1.18), rinsing the flattened glass rod and the platinum crucible with the acid as it is added. No water should be added. Complete solution of the sample with a small stirring rod, place a watch glass over the beaker, and heat on a steam bath for thirty minutes.

In the case of clinker and cement, mix together 0.5 g. of the sample and an equal quantity of ammonium chloride, add 5 ml. of acid, and stir with a glass rod until solution is complete. During the interval of digestion, stir occasionally with the stirring rod if lumps seem to appear.

Fit a 11-cm. quantitative filter paper of medium fineness to a funnel, and wash the paper once with hot one percent nitric acid. Break up the gelatinous mass in the beaker with a jet of the hot wash solution, stirring

TABLE I—EXPERIMENTS BY THREE ANALYSTS ON SAMPLES OF LOW HEAT CEMENT

Sample		Fed. Spec. SS-C-158 Analyst A	Deviation from Avg. value	NH_4Cl method Analyst B	Dev. from Avg.	NH_4Cl method Analyst C	Dev. from Avg.	Avg. value for 3 analysts
I	SiO_2	.1137	+.0001	.1137	+.0001	.1133	—.0003	.1136
	R_2O_3	.0569	—.0001	.0569	—.0001	.0571	+.0001	.0570
II	SiO_2	.1138	+.0005	.1129	—.0004	.1131	—.0002	.1133
	R_2O_3	.0568	.0000	.0569	+.0001	.0566	—.0002	.0568
III	SiO_2	.1128	—.0002	.1131	+.0001	.1132	+.0002	.1130
	R_2O_3	.0562	—.0004	.0570	+.0004	.0565	—.0001	.0566

* Geo. P. Horn, one of the authors, is chief chemist, Longhorn Portland Cement Co., San Antonio, Texas. The others who collaborated in the preparation of the article are associated with Mr. Horn.

TABLE II—ANALYSIS OF PORTLAND CEMENT SAMPLE BY AMMONIUM CHLORIDE RAPID METHOD COMPARED TO FEDERAL AND A.S.T.M. METHODS

	Fed. Spec. SS-C-158				NH_4Cl Rapid Method				A.S.T.M. Spec. C 114-34 T				
	A	Dev. From Avg.	B	Dev. From Avg.	A	Dev. From Avg.	B	Dev. From Avg.	A	Dev. From Avg.	B	Dev. From Avg.	Avg. Value
Crude SiO_2	.1072		.1086		.10		.1062		.1062		.1061		
Residue After HF treatment	.0011		.0017		.0004		.0002		.0002		.0004		
Refined SiO_2	.1061	.0000	.1069	+.0008	.1062	+.0001	.1060	—.0001	.1060	—.0001	.1057	—.0004	.1061
R_2O_3	.0391	+.0004	.0381	—.0006	.0393	+.0006	.0389	+.0002	.0379	—.0008	.0389	+.0002	.0387

further with a glass rod, so as to break up any large lumps, and transfer to the filter. Break up the silicic acid in the cone with a jet of the hot nitric acid solution until no further coloration of iron is evident. Loosen the particles adhering to the beaker with a rubber policeman, washing them into the filter. Finally, wash the silicic acid mass ten times with the hot wash solution, breaking up the precipitate each time with strong jets of the acid wash solution. Ignite at 1100 to 1200 deg. C. to constant weight.

Precipitate the iron and aluminum in the filtrate with ammonium hydroxide as outlined in the Federal and A.S.T.M. methods.

The determination of calcium oxide may be shortened by precipitating as the oxalate, as in the usual methods. After cooling, filter through a fine filter and wash ten times with ten percent ammonium hydroxide solution. Into the beaker in which the original precipitation was made, pour about 25 ml. of cold water, 20 ml. of conc. H_2SO_4 (sp. gr. 1.8), and dilute to 200 ml. with hot water. To this hot solution, add the filter paper containing the washed calcium oxalate, and titrate with standard potassium permanganate (0.4 N).

A blank determination should be run at the same time the actual samples are run, and corrections made accordingly. After several blank determinations have been run and the corrections determined, the same corrections may be used in all routine work, and a blank need only be run occasionally.

Discussion of the Method

This rapid determination is not intended to supplant the standard procedures, but is only to be used when the accepted methods would require too much time to be of immediate use. This ammonium chloride method makes it possible to make a complete oxide analysis of a sample of limestone, clinker, or cement in about an hour and a half, rather than the usual time of several hours required by the longer methods. This time does not include the determination of magnesia.

In addition to its speed, another advantage of this procedure is its consistent accuracy, due to the small number of manipulations required. It can be duplicated with great accuracy. Repeated experiments have shown that the weight of a silica precipitate can be checked consistently to .0005 g., on a sample of 0.5000 g. Table I shows the results of experiments by three analysts on three separate samples of cement. The ammonium chloride method is compared to the Federal method outlined under Specification SS-C-158. The results for the ammonium chloride method are uncorrected with regard to hydrofluoric acid treatment of the silica.

Table II gives a comparison of the ammonium chloride method with both the Federal method and the A.S.T.M.

TABLE III—RESIDUES AFTER HF TREATMENT OF SiO_2 ON 0.500 g SAMPLES RUN BY AMMONIUM CHLORIDE METHOD

Experiment	Corrected Slurry	Clinker	Cement
1	.0002	.0002	.0002
2	.0000	.0000	.0004
3	.0005	.0003	.0003
4	.0003	.0000	.0002
5	.0004	.0002	.0005
6	.0007	.0002	.0000

procedure outlined under Designation C 114-34 T. In this table, the results of the ammonium chloride method, as well as the others, are corrected for hydrofluoric acid treatment of the silica. Duplicate samples of each method are shown.

Experiments have proved that the silica obtained by this method is almost as accurate as that obtained by other methods using hydrofluoric acid to separate the silica from R_2O_3 contamination. Even in samples with a relatively high percentage of iron and alumina, the silica is found to be almost entirely free from contamination by these oxides. Table III gives the figures obtained for residues after hydrofluoric acid treatment of silica.

Table IV is a comparison, on a percentage basis, of analyses of the same sample by the Federal method and the ammonium chloride method. The silica results for the ammonium chloride method have not been corrected with hydrofluoric acid, while those for the Federal method have been treated with HF. The R_2O_3 and CaO results are given to allow study of the relative accuracy of the uncorrected NH_4Cl method (volumetric CaO determination) compared to the corrected Federal method (gravimetric CaO reprecipitated).

The use of hot one per cent nitric as a wash solution for silica is recommended because it was found that at this stage of the analysis, the iron and alumina tend to become imbedded in the thick jelly-like mass in the filter cone. This can not satisfactorily be washed out mechanically with hot water, consequently dissolving out with acid is necessary to separate the silica from these impurities. This is found to be especially true of cement samples high in iron.

In subsequent work, this laboratory will endeavor to establish the utility of the ammonium chloride procedure for analysis of other argillaceous materials, such as clay, marl, Fuller's Earth, etc., which are not at present satisfactorily analyzed by the method described.

TABLE IV—ANALYSES OF THE SAME SAMPLE OF LOW HEAT CEMENT BY FEDERAL AND AMMONIUM CHLORIDE METHODS

	Sample	% SiO_2	Dev. From Avg. %	% R_2O_3	Dev. From Avg. %	% CaO	Dev. From Avg. %
SS-C-158 Method	1	22.82	+.09	11.42	—.01	61.56	—.03
	2	22.66	—.07	11.48	+.05	61.50	—.09
	3	22.70	—.03	11.38	—.05	61.71	+.12
	Avg.	22.73		11.43		61.59	
NH_4Cl Method	1	22.74	—.01	11.46	.00	61.60	—.07
	2	22.74	—.01	11.48	+.02	61.71	+.04
	3	22.78	+.03	11.44	—.02	61.71	+.04
	Avg.	22.75		11.46		61.67	

Calcining, Hydrating Lime

Part 3. Four kiln control factors—time, temperature, flow and size — affecting production and quality discussed in the Lime Forum this month.

By VICTOR J. AZBE*

OF THE FOUR main control factors—the time, temperature, flow and size—the first is governed by the period of draw and the capacity rate; the second by delayed combustion and re-circulation of kiln gases, the third by arrangements to facilitate proper drawing and proper trimming, and the fourth by limiting the size of stone and aiming at uniformity consistent with plant facilities. It is better to feed different sizes to the kiln separately and thus form layers, than to feed all the extreme ranges together.

Proper procedure, however, is dependent upon the kind of stone available and what kind of lime may be desired. May it be high in acid soluble, or must it be high in water soluble CaO? Should it be quick or slow settling? Must it hydrate rapidly? Of course, we want it low in residue! Is it important that it makes a creamy rather than a stiff putty, or a plastic mortar? Should it be particularly low in CO_2 or in sulphur or arsenic or flourine? In the case of dolomitic stone is it not important that it be a very soft rather than hard burned, particularly when making finishing hydrate? Must not recarbonization be avoided? Is great care not important to assure a magnesia that will at least in part hydrate without resorting to pressure hydrators? Is crumbling up of lime in the kiln not upsetting both to the kiln and probably to the plant through excessive amounts of fines? May it not be that color of lime is impaired or that siliceous slags form and spread, destroying good CaO by either combination or occlusion? Is it not rapidly coming to a point where precise chemical industries will either get the exact lime they want or make it themselves? Is not lime a chemical and as such should it not be definite in character rather than a haphazard mixture of all ranges, most of it impaired, some to uselessness by improper calcining methods as some of the lime sold today is?

All sorts of efforts may be made at proper hydration but if lime out of the kilns is poor to begin with, special treatment later may make it better, but never the best. The source of most trouble is in the kilns and it is there that it should be corrected. Almost all the trouble is caused by either improper time of burning, improper temperature of burning or improper sizing. Of course, stone may be poor, but the poorer the stone the better should the calcination process be.

It used to be said that good, high calcium lime is not sensitive to temperature and time factors of burning, but it is only meant that it is not as sensitive. The very best of lime can be hurt, poor lime far more and dolomitic lime, particularly when not exceedingly pure, the most.

As a whole, high efficiency is opposed to high quality and to get both requires special provisions. High efficiency may mean high temperatures and high temperatures are less likely to give good lime, particularly when kiln manipulation is in any way inexpert or arrangement improper.

We may have two kilns standing side by side. One is arranged to give a ton of lime per square foot of shaft area and a ratio of 5 to 1. The other gives only ½ ton per square foot and a ratio of 3 to 1. But the first kiln may make lime of 85% availability as determined by the sugar method and the second, lime of 93% availability. On the other hand, the high capacity kiln may have a per cent or two more of acid soluble CaO. Evidently the first lime is definitely poorer for some purposes and to satisfy the customers something must be done to improve it. That is possible without impairing efficiency and capacity too much.

At first glance, it may seem impossible, but it is not so at all. Many lime plants established their reputation when their kilns were fired with wood, but with coal they always have had more or less trouble. As then fired, wood was not able to give high temperatures and the lime was therefore very soft-burned. But it is not altogether the temperature; the time is also a great factor.

High temperatures can be used if the kiln is drawn often, but to leave lime with no core in the highest temperature section of the kiln is bound to hurt. If it is of the follower type, it must be drawn every hour; if it is a hanger, every 1½ or 2 hr. To run kilns 4 and 6 hr., as often is the case, is just a bad habit. Of course, the kiln arrangement must be such that this frequent drawing can be accomplished properly.

Size of stone also is important. If stone is too large, and in almost all lime plants most of it is too large, and temperatures high, the outside of the lump will be overburned even when there is still core in the center. Lime is very porous, its heat conductivity is low, and to get the required amount of heat into the middle to calcine the core of a 6 to 8-in. minimum size piece, a rather high outside temperature is necessary, or else a long time is required, or both, thus seriously impairing the surface lime. As most of the lime is on the outside, most of the lump will be overburned for the sake of the disposal of the small core in the center. If stone is small and fairly uniform such great temperature differences are not needed and the lump of lime will be more uniform throughout. Stone of half size requires a time-temperature calcining effort of less than half.

In a kiln where temperatures are not controlled, the hot zone contains large lumps of lime which are drawn into the cooler every 4 hr. To assure low core in the draw, most of those large lumps have very little core when they get into the hottest section and some have none at all. If there is any core, it is deep-seated and the heat has to be driven through a thick layer of lime, which means that the surface is very hot. Lumps with core do not get quite so hot as a whole, but the coreless lime almost reaches the flame temperature and that may readily be 2500 deg. F. or more, and the lime is exposed to this heat for hours.

When the lime is drawn a great mass of it passes into the cooler, the air com-

*From a paper presented before the recent Lime Symposium in Columbus, Ohio, held under the auspices of the A.S.T.M.

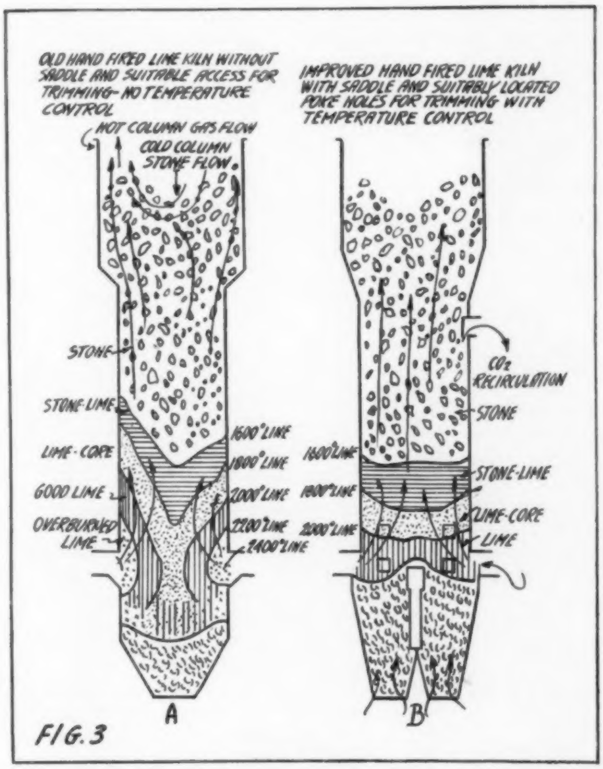


Fig. 3-A: Shows kiln design in which there is a tendency to overburn lime. Fig. 3-B is an improvement in this design

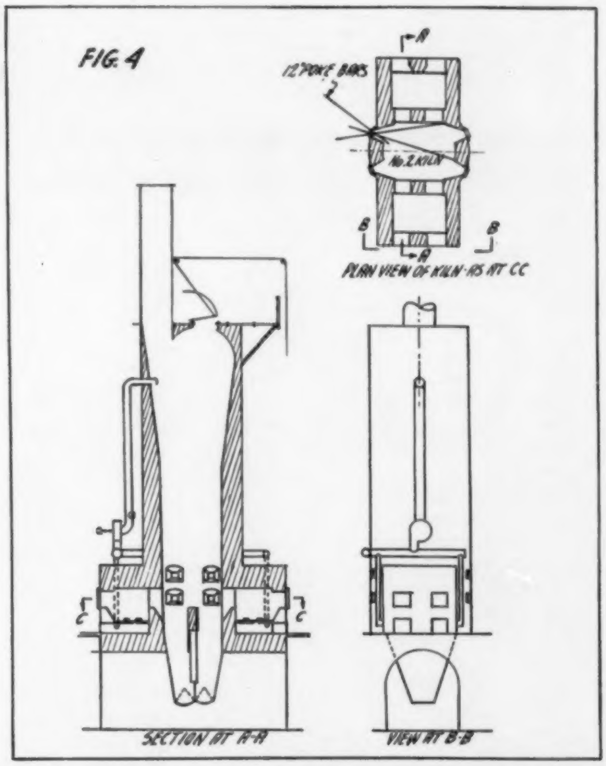


Fig. 4 represents a simple but efficient type of hand-fired kiln designed to reduce troubles from over-burning

ing up through the cooler becomes intensely preheated and far hotter on 4-hr. than 2-hr. draws. Air temperatures may readily reach 2200 deg. F. or more when the fuel is admitted. Combustion further raises its temperature, but as long as the lime is able to abstract heat, the climb in temperatures is not as high or as fast as when lime is already practically coreless. With large lumps, the hot zone contains far less heat absorbing surface than with small lumps, the heat absorbed cannot keep step with heat developed, and temperatures climb very rapidly.

If the kiln is drawn more often the air coming up from the cooler would be of a more constant temperature and never quite so hot, and then it would not be required to pass through a layer of overly hot lime several feet thick. The completely burned piece that chanced into the hot section would also not sinter for such a long time but would be moved on its way. Packing of lime would be changed, if the kiln were drawn more often, removing some and bringing other surfaces under the action of greatest heat, thus equalizing its effect.

If the limestone were 4 in. instead of say 8 in., minimum dimension, the hot zone would contain twice the surface for absorbing the heat, and heat absorption will be better able to keep step with heat generation. A square foot of surface stone of half the size has to absorb only half the heat and the depth of lime through which the heat has to be delivered to the core is only half, so surface temperature need not be as high to assure coreless lime.

Frequent drawing means a more constant volume and a cooler primary air which is conducive to lower temperatures, also faster removal of lime from the hottest sections. Smaller stone means more heat absorbing surface, leading toward lower temperatures, due to faster absorption and smaller penetration; this, combined with lesser absorption per unit of surface, leads toward the essential lower temperatures.

There may be many arguments against frequent drawing, operating arguments such as cleaning of fires, hanging of kilns and changing of shifts, but they should and could be mastered without lengthening the draw period. Smaller stone and higher gas velocities with lower temperatures will give us the same capacity and efficiency, as large stone, sluggish gas velocities and high temperatures will; but in the first case, the lime will be good, in the second poor. Very often, just reducing stone size and increasing the draft and frequency of drawing will improve the quality of lime to a satisfactory degree. But this is not always the case—particularly with impure stone or when the lime is of high magnesia variety, or especially if such lime is high in silica, iron or alumina or is intended for finishing purposes. It is then necessary to resort to gas recirculation or to steam for tempering, but steam is expensive and both practices are wasteful.

Advantages and Disadvantages of the Eldred Process

The Eldred process of gas recirculation has been used for many years, and is still proving quite useful, particularly when lime is of high magnesia kind. Of course, very often it was misapplied or used so crudely that results were poor. However, even when correctly used, kiln capacity and fuel ratio were so much less, though lime obtained was much better, that hardly ever were temperatures conditioned sufficiently to give truly premier lime. When steam was the tempering agent a sufficient amount was even less likely to be used, because steam was costly to produce and was required in entirely too large amount to get the temperature down to a point necessary for the best dolomitic lime.

The difficulty was that the fairly cool gases were drawn from the top of the kiln and in passing through pipes they cooled still further and were then re-

(Continued on page 98)

Hints and Helps

★ FOR SUPERINTENDENTS ★

Shooting Thin Ledge of Stone

By JOHN F. ROBINSON
Supt., Cedar Bluff Quarry

IN THE DEVELOPMENT of the Cedar Bluff Quarry, Princeton, Ky., it became necessary to remove a ledge of stone averaging less than 6 ft. thick. The rock is excellent, but presents great difficulty in shooting on account of the very tight parting at the bottom and the laminated structure of the ledge. The tendency was to split out enormous flat blocks and leave a tight bottom, which had to be cleaned, drilled, and shot, before the steam shovel could handle it. The further difficulty of moving track frequently and the interruptions to production caused by cleaning up to the face in order to eliminate back breaks seemed, all told, to present an almost insuperable problem.

As anyone familiar with quarrying well knows, these problems were not all solved the first time we made an effort. Therefore, we will skip the sad history of our experiments and describe just how this was made into a very satisfactory operation.

One hundred and twenty-five 1¾-in. holes were drilled with the slide-mounted Ingersoll-Rand X-71 drill, using 1¼-in. hollow round steel. They are drilled about a foot below grade, and spaced 4 ft. apart, with each line of holes 4 ft. back of the preceding line. Drilling averaged about 40 ft. an hour. The entire round of drilling and shooting was kept far ahead of the steam shovel.

Hercules 1¼-in. x 8-in. Gelamite "2" was used for the shooting, and the holes were blown when necessary with compressed air. The wrappings were removed from the first four sticks of dynamite and the loose dynamite was carefully packed into a foot of space at the bottom of each hole. This part of the operation was vital. If larger holes were drilled, the drill would be slowed down so much that we could not keep up with the shovel, and springing, or delay exploders were too expensive. Removal of the wrappings was made safe for the one man who did it by the use of rubber gloves. Cheap ones were bought and thrown away after each shot. This eliminated the familiar "dynamite headache." The usual primer, with electric blasting cap, was then placed in the hole and followed by enough dynamite, slit and tamped, to bring the charge up to 3.25 tons of rock per pound of dynamite. Stemming was added and the exploders were connected in parallel and shot with a switch on the 110-volt power line.

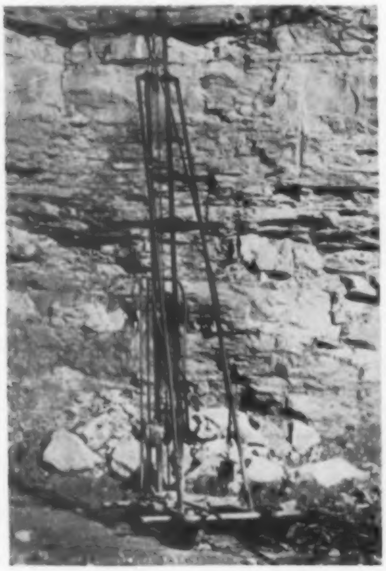
Results, as illustrated, were most excellent as to breakage, and the bottom comes up perfectly. An indefinite number of shots could be piled up on one another, because the breakback was never more than the height of the face. The unusual method of loading never failed to bring out the toe in excellent condition. Secondary shooting was practically unknown, and this item alone made up the extra cost of the frequent shooting and the number of exploders per ton of rock. Shovel production was well above average, for, by piling up several shots, the rock pile has been kept thick enough to eliminate extra moving of shovel or track.

Pulp Density Control

By WALTER B. LENHART

CONTROLLING the flow of a thick abrasive pulp from a Dorr thickener by means of valves soon wears out the valves or causes them to stick. The valve also tends to obstruct the flow so that eventually a dam is built up sufficient to stop the flow entirely. This is particularly true when the pulp is high in solids and is correspondingly thick and soupy.

A satisfactory method of controlling the flow is to have a series of discharge bushings, each bushing being of slightly larger diameter. As an illustration, one western operator has a 2-in. line and at the discharge end puts in a bushing which reduces the opening to ¾-in. A second bushing can enlarge the ¾-in. opening to 13/16-in., thus giving a slightly larger flow of pulp. The other bushings are ⅞-in., 15/16-in.,

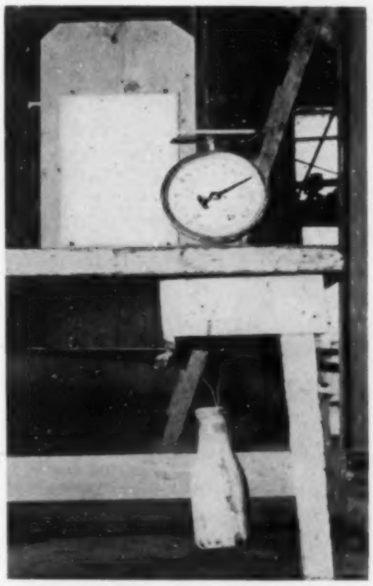


Left: Slide-mounted drill used for drilling blast holes. Center: Showing breakage compared with size of workman. Right: Shovel loading stone

1-in., 1 1/16-in. 1 1/8-in. 1 3/16-in., 1 1/4-in., 1 5/16-in., 1 3/8-in. and 1 7/16-in. These are all made in the local shop by reaming out a standard pipe bushing to the desired size. They give a wide range of discharge orifices and corresponding volumes.

To determine when it is necessary to change a bushing the operator fills an ordinary quart milk bottle with pulp and weighs it. From a table he reads the percentage of solids in the pulp, and if a lighter pulp is desired he puts in a larger bushing thereby discharging the thickener faster and lowering the solids per unit of measure.

The scales used are ordinary household scales but are provided with a hook under the platform so that the



Simple pulp density control device, using a milk bottle and small household scale

milk bottle can be hung on the scale beam. This prevents the scale pan from becoming dirty (and out of balance) from a gradual accumulation of muck off the milk bottle. A wire bale is attached to the milk bottle for a handle.

By using a quart milk bottle for this work, an inexpensive, constant volume and easily available container is obtained.

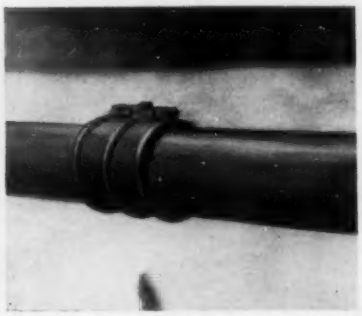
The illustration shows the scale assembly, and the chart (protected by glass, for cleanliness) for controlling the rate of flow and pulp density at this operation. A copy of the chart by which readings are obtained is appended. This chart calls for a pulp whose solids are 3.2 specific gravity, and if lighter solids are in the pulp a correction will have to be made.

The table is based on the use of a quart milk bottle which holds 943 cu. cm. when filled 3/16-in. from top. The weights are in *pounds* and *ounces* and the gross weight is the

Gross Weight Pounds	Gross Weight Ounces	Percent Solids
4	½	10
4	1	12
4	2	14
4	2½	16
4	3	18
4	3½	20
4	4	22
4	5	24
4	5½	26
4	6	28
4	7	30
4	8	32
4	8½	34
4	9	36
4	10	38
4	11	40
4	12	42
4	13	44
4	13½	46
4	14½	48
5	0	50

figure to use. The table gives only the approximate percentage of solids in the pulp.

Cast Steel Couplings For Straight Line Pipe



Left: Single piece cast steel coupling for pipe connected in a straight line. Right: coupling in place on 12-in. dredge pipe

CAST STEEL COUPLINGS in the pipeline of a Southern plant pumping a mixture of sand and gravel approximately 1100 ft. in a 12-in. dredging operation are being used instead of rubber couplings wherever pipe are connected in a straight line. Of course, wherever there is an angle in the line rubber couplings are used. One piece or two piece couplings are used.

The single piece coupling is made in 16-in. and 24-in. lengths and is circular but open at one place, where four ¾-in. bolts are used for tightening. The inside diameter of this coupling is slightly less than the outside diameter of the pipe to be joined, to allow for tightening. The thickness of the material is ⅝-in. at the circumference, opposite the opening, and increases gradually to ⅞-in. toward the opening, giving springiness and grip to the coupling. The inside is smooth and accurately machined. The two ends of pipe to be joined, meet flush at the center of the coupling, and when the bolts are drawn up a small piece of wood is inserted at the one small opening which will be left. The two piece coupling operates in the same way except that it is bolted on both sides.

No welding or threading is needed, and pipe are connected in this manner with little loss of time. Whereas rubber tubing will wear out, these couplings will give almost unlimited wear, and with the pipe fitting flush together, resistance and consequently pipe losses are cut-down. The coupling enables shorter pipe to be used and permits installation with fewer men. The initial cost is slightly higher, but over a long period of years there has been marked savings in the use of the cast-steel couplings.

Care of Skin Burns From Lime and Cement

SKIN BURNS from handling lime and portland cement may develop into extremely serious skin conditions, states an item in the *National Safety Council News Letter*. A neglected skin irritation beginning at the edge of a wound, after some months of improper self medication, finally developed a degree of sensitivity so great that contact with wet concrete for one day resulted in swelling of the arm to more than twice normal size. Skin burns are caused by the caustic action from the hygroscopic properties of lime, caustic lime, and silicic acid. In addition a mechanical irritant action may also occur. It has been found, in some lime plants, that unscented talc powder dusted on the skin provides a more cleanly form of protection than coating the skin with greases. When irritations do develop prompt and proper treatment with mild palliative lotions or ointments under the direction of a competent dermatologist and removal from exposure are indicated.

NEWS ABOUT PEOPLE

EUGENE D. HILL, vice-president and sales manager of the Louisville Cement Co., Louisville, Ky., has assumed duties as president after William S. Speed, who had held the post since 1912, was made chairman of the board. Mr. Hill joined the company as assistant sales manager in 1922. Harry D. Baylor, vice-president and works manager, was elevated to the presidency of the subsidiary companies.

•

CLYDE N. BATES has been appointed assistant sales manager for Gulf Portland Cement Co., Houston, Tex. He is a graduate of Texas A. & M. College, and was formerly with the Texas State Highway Department and the Portland Cement Association.

•

M. S. ACKERMAN, JR., manager of operations for the Northampton, Penn., plant of the Lawrence Portland Cement Co., has taken over management of the Thomaston, Mo., plant in a consolidation of positions. The consolidation releases the services of C. H. Sonntag, who has been plant manager of the Thomaston mill for the past ten years.

•

M. A. SWAYZE, director of research, Lone Star Cement Corp., Hudson, N. Y., has been nominated as a member of the executive committee, American Society for Testing Materials. Mr. Swayze has been identified with the cement industry and the use of concrete since 1912 when he graduated with the degree of B.S. in Chemical Engineering from Case School of Applied Science. He has been associated in various positions with the Crescent Portland Cement Co., Texas Portland Cement Co., International Cement Co., and Lone Star Cement Corp. Mr. Swayze has been very active in the work of Committee C-1 and is chairman of the high-early-strength cement subcommittee. He represents the Portland Cement Association on the Joint Committee on Concrete and Reinforced Concrete and is member of the Technical Problems Committee of the P.C.A. Mr. Swayze also is a member of the Committee on Research of the American Concrete Institute.

•

HOLCOMBE J. BROWN is the new president of the Engineering Societies, Boston, Mass., after having served as vice-president for three years. After graduating from Harvard in the class of 1902, Mr. Brown was associated for many years with one of the country's leading gypsum concerns. He is now a consulting engineer, and a recognized authority on non-metallic mining and mineral separation. He has designed several complete gypsum plants.

Holcombe J. Brown

•

ALBERT R. COUCHMAN has been appointed traffic manager of the North American Cement Corp., New York, N. Y.

•

DING BURTON has been named sales manager of Ash Grove Lime & Portland Cement Co., Kansas City, Mo., to succeed the late William R. Anderson. Mr. Burton joined the company in 1930 as a special representative on contract sales and was appointed assistant sales manager in 1938. A. B. Sunderland, formerly secretary and assistant treasurer, has been appointed vice-president and secretary and R. H. Florence has been made sales office manager.

•

GEORGE S. NEEL of Des Moines, Ia., has been appointed sales manager of Universal Atlas Cement Co.'s Chicago metropolitan area.

•

F. R. KANENGEISER, SR., general manager of the Superior Cement Co., Portsmouth, Ohio, has resigned on account of illness. E. H. Davis of Columbus, Ohio, has been appointed to take his place.

•

J. A. MCCARTHY has been elected president of the Pacific Portland Cement Co., San Francisco, Calif. With other changes the management is now: W. F. Humphrey, chairman of the Board of Directors; J. G. Sutton, J. H. Colton, and J. D. McKee, vice-presidents; A. H. Canvin, secretary and treasurer; J. Schoening, Jr., assistant secretary; and directors, Wakefield Baker, R. R. Boutell, J. H. Colton, Charles Elsey, Herbert Fleishhacker, W. F. Humphrey, H. C. Hunt, J. B. McCargar, J. A. McCarthy, J. D. McKee, and J. G. Sutton.

•

JAMES W. GENTRY of Chattanooga has been named chief engineer of the Tennessee Highway Department.

Obituaries

FRANKLIN R. JOHNSON, president of the Aetna Portland Cement Co., died at his home in Brookline, Mass., July 19. He was 75 years of age. Mr. Johnson also was advertising manager for the United Shoe Machine Corp., and director of the What Cheer Mutual Fire Insurance Co., the Hope Mutual Fire Insurance Co., and the Brookline Trust Co.

•

REUBEN W. EBERLY, retired president of the Buffalo Gravel Corp., Buffalo, N. Y., died recently at the age of 60, after a long illness which caused him to retire two years ago.

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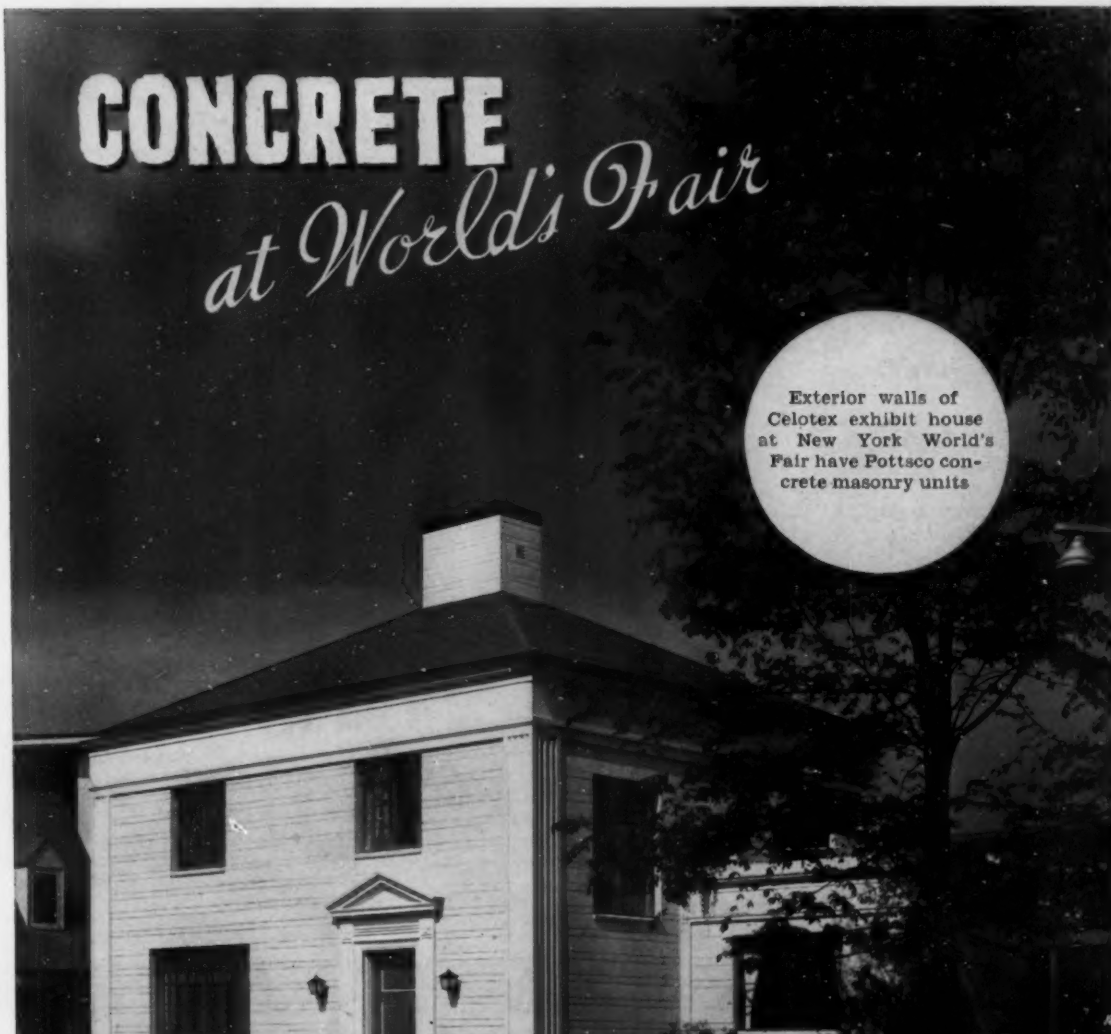
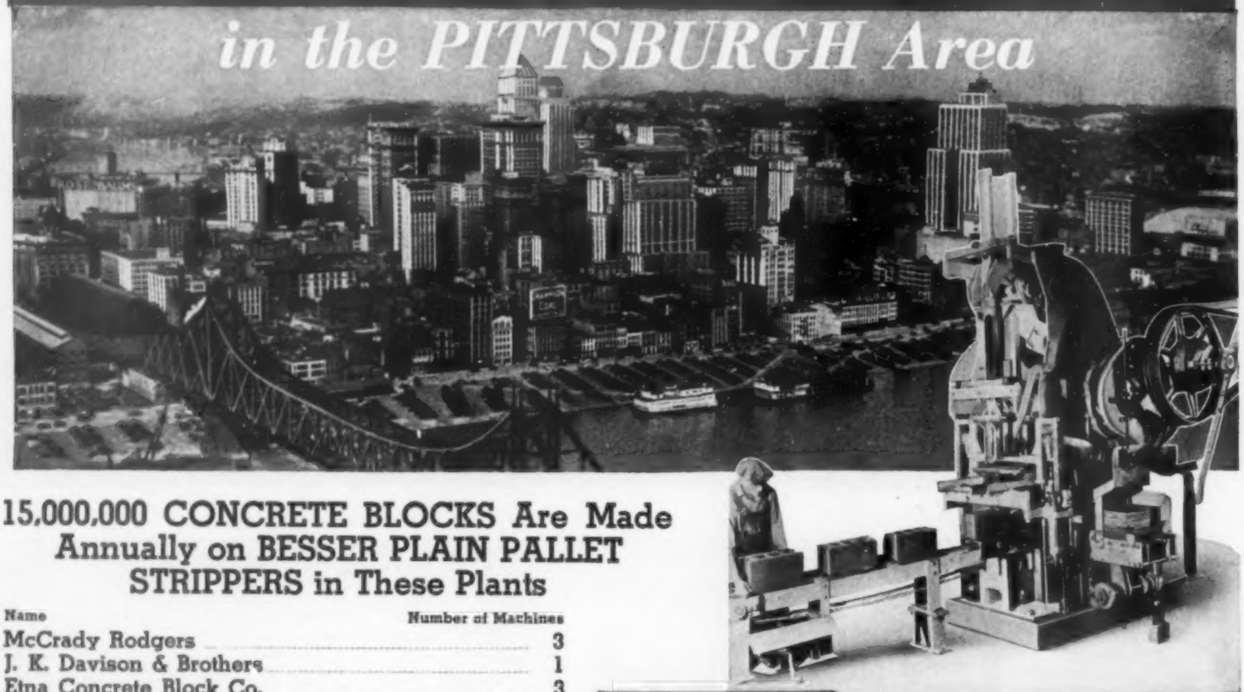
LINCOLN M. THOMPSON, one of the owners and founders of the Thompson-Young Sand Co., Jefferson City, Mo., died June 12. He was 57 years of age.

CONCRETE PRODUCTS AND CEMENT PRODUCTS



Exterior walls of Celotex exhibit house at New York World's Fair have Pottsco concrete masonry units

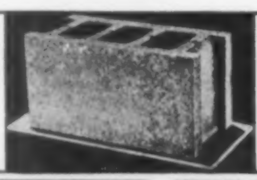
Over 90% BESSER



15,000,000 CONCRETE BLOCKS Are Made Annually on BESSER PLAIN PALLET STRIPPERS in These Plants

Name	Number of Machines
McCrady Rodgers	3
J. K. Davison & Brothers	1
Etna Concrete Block Co.	3
General Cement Products Co.	3
Ed Veero Company	1
R. I. Lampus	1
Anchor Block Company	1
D. Carapellucci	2
Limestone Products Supply Co.	1
Schwarzmeier-Kress Building Supply Co.	1
Ambridge Block Company	1
Morrison Brothers	2
Rennekamp Supply Company	2
Tube City Block Co.	1
J. F. Scott Co.	2
Chartiers Cinder Block Co.	2
Presto Block Company	1
Patterson Supply Co.	1
Monaca Concrete Block Co.	1
I. Koontz	2
Patsy Rega	1
Keystone Building Supply Co.	1
Caleb Lee	1
Shufflin & Green	1
George Lanz & Sons	1
H. Suplit	1
Charleroi Supply Company	1
Hawkins Concrete Block Co.	1

FULLY PRESSED TOP Concrete Blocks



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Besser Victory Automatic Plain Pallet Stripper Daily Capacity 2000 to 2500

Besser Semi-Automatic Plain Pallet Stripper Daily Capacity 1200 to 1500

Besser Champion Power Operated Plain Pallet Stripper Daily Capacity 1000 to 1200

Besser Multi-Mold Hand Operated Plain Pallet Stripper Daily Capacity 250 to 350

BESSER VIBRAPAC PLAIN PALLET STRIPPERS

Besser Automatic Vibrapac Plain Pallet Stripper Daily Capacity 4000 to 5000

Besser Power Operated Vibrapac Plain Pallet Stripper Daily Capacity 2000 to 2500

BESSER-FLAM VIBRATOR

Besser-Flam Plain Pallet Vibrator Daily Capacity 800

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EVERY CONCRETE PRODUCTS PLANT NEEDS A BESSER PLAIN PALLET STRIPPER

Large Structure Market

Lightweight concrete masonry units are now finding a ready acceptance in Atlanta, Ga., for schools, apartments, and industrial plants

By BROR NORDBERG

MANY LARGE METROPOLITAN AREAS are termed "conservative" in their buying habits, particularly in their selection of building materials. Atlanta, Georgia, had been that kind of a city until J. S. Bailey, proprietor of Concrete Manufacturing Co., set out to do a job of merchandising.

Until 1936, when Mr. Bailey introduced lightweight concrete block made by vibration, the market was decidedly limited. Heavy concrete masonry units had been the only type available and their usage had been confined to foundations and other miscellaneous jobs with a limited volume.

Masons in Atlanta objected to the weight of an 8- x 8- x 16-in. block, so the bulk of the sales prior to 1936 were 3½- x 8- x 12-in. and 5- x 8- x 12-in. sand and gravel block. Many cities throughout the South have this aversion to weight, making a lightweight aggregate desirable for that reason as well as because of other advantageous properties attributable to such lightweight aggregates.

Concrete masonry had not been sold as a product having quality standards and as a result, types of jobs which rightfully should have been sold in concrete masonry were not.

Popularize Lightweight Units

Mr. Bailey started manufacturing sand and gravel block in 1933, and therefore was familiar with the market with which he had to deal. He decided to manufacture lightweight block exclusively. For below-grade construction, a waterproofed cement stucco application is recommended.

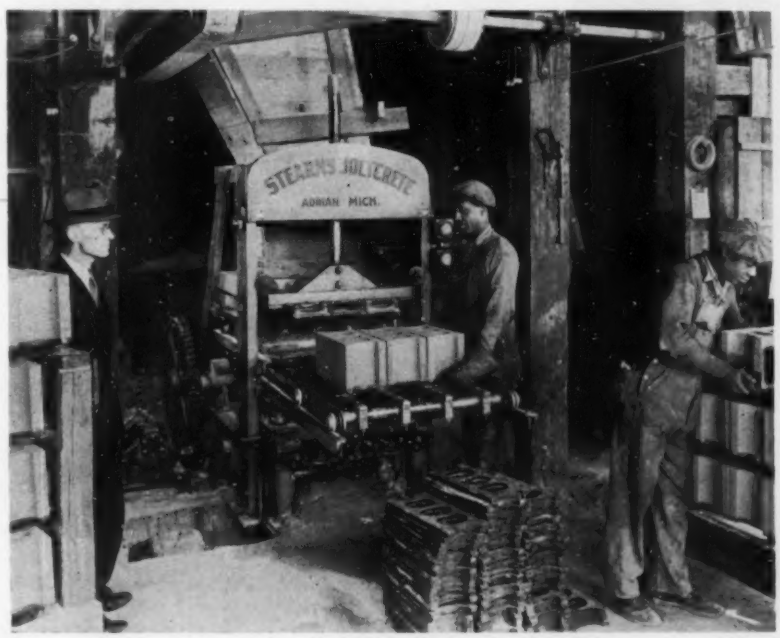
A new plant was built in 1936, with a powered vibrating machine, using Superock aggregate which is an expanded blast furnace slag manufactured in Birmingham, Ala. It is claimed that by this process the aggregate has a cellular structure with high insulation properties, lightness in weight, nailability and acoustical value. These properties, plus a unit having straight, true edges and good workmanship, are the foundation of Mr. Bailey's promotional work.

Racks of concrete units are transferred into the curing kilns by power lift truck. On the extreme right is the new vibrating block machine

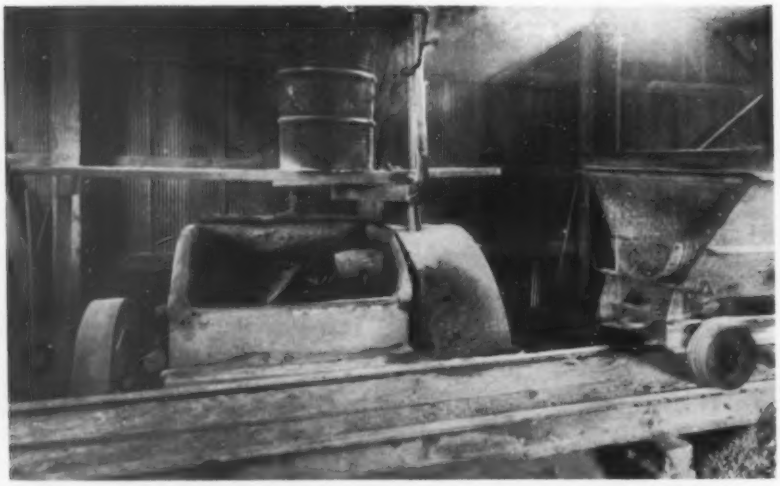
With the present product, Mr. Bailey netted a volume of 50,000 units the first five months; in the next six months he sold 200,000 and the sales curve is on the way up. Small house foundations, filling stations, garages, etc., make up the steady volume, but "Superock" units are now finding acceptance as backup in school buildings, apartment buildings and industrial plants. These larger structures represent an entirely new market in Atlanta, which was previously untouched. To promote his products Mr. Bailey devotes practically all his time to demonstrating the units to architects, contractors and other buying officials.

Manufacturing Procedure for Quality

While the new plant has no particularly unusual features, it is modern in every respect. Production is about 400 per hr. 8- x 8- x 16-in. units or the equivalent in 4's, 6's and 12's with an 8- x 16-in. face—all manufactured on a Stearns Joltcrete machine. Aggregate comes in cars from Birmingham in two sizes. Coarse aggregate is graded from ⅜-in. to 10-mesh and the fines are graded from ¼-in. down.



Vibrating block machine installed to make light-weight units. John S. Bailey, manager, is standing to the left



Concrete mixer, on floor above the machine floor, showing measuring hopper for feeding aggregates into mixer. Mixing water is heated the year-round to quicken the setting action of the cement

The proportions of each size aggregate used in a mix give some latitude in properties which the unit will have and are varied according to requirements on the job. Generally, the rule is to use as much coarse aggregate as is possible to produce better acoustical values and for better insulation, while keeping the compressive strengths as high as possible. To make a finer-textured block, proportions are adjusted in the mix.

As compared to units formerly made, less labor is required in the new plant and the amount of material used in the blocks has been reduced as compared to tamping with the same aggregate. This is due in some measure to the practice of keeping the percentage of coarse aggregate as high as compressive strength limitations will allow.

Aggregate is discharged from hopper-bottomed cars into the boot of a bucket elevator emptying into a Johnson two-compartment bin. Bin capacity is two carloads, one of each size material. A Chase measuring hopper, rail mounted and propelled, is used to charge a 28-cu. ft. Stearns mixer above the block machine. The hopper, which feeds the concrete to the block machine, has a chute through which concrete may also be diverted to feed a Stearns power stripper.

This machine is used to manufacture 6-in. units. Aggregate is first discharged into the mixer, followed by the water and then the cement. A 15 cu. ft. mixer is used for making joists, lintels and other precast products.

Heat Mixing Water Year Round

An interesting feature of operation is that the mixing water is heated to about 125 deg. F. in summer as well as in winter, to speed up the cement-water reaction. Mr. Bailey finds this practice of value in reducing corner breakage in handling green block to and from the curing kilns and in stock. The same steam boiler equipment used to develop low pressure steam for curing, heats the mixing water.

(Continued on page 86)

Building Experience Into New Ready-Mixed Concrete Plant

Control of batching plant by one man with electric interlocking for bulk cement handling and bin level warning indicators

By BROR NORDBERG

READY-MIXED concrete is a young industry, which is destined to see many advances, particularly in the matter of handling materials. Delivery equipment has developed rapidly due to the foresight of the mixer and truck company engineers, and new technological developments have placed higher standards on ready-mixed concrete.

Left to right: O. M. E. Dankel, manager of ready-mixed concrete operations and assistant secretary, and C. E. Loizeaux, president of the company

It is difficult to draw a comparison between the plants of today and the past as most ready-mixed concrete plants are still comparatively new in the business; and other plants are still too modern for replacement.

Loizeaux Builders Supply Co., Elizabeth, N. J., a pioneer in the ready-mixed concrete industry and the first concern in the East to use bulk cement, has just completed an entirely new transit-mix batching plant that offers some interesting comparisons with the older plant it displaces. After ten years' operation of the first plant, the company saw the need for a new unit having features which the old lacked and which are necessary for more efficient operation. The new plant was designed by engineers of the Blaw-Knox Division, Blaw-Knox Co., to specifications of O. M. E. Dankel, assistant secretary and manager of ready-mixed concrete operations of the company. It was also built by Blaw-Knox Co.

Crushed stone, gravel and sand are received by barge. Between the dock and the plant, a rail-mounted, electric Lambert crane with 1-1/3 cu. yd. Hayward bucket loads directly from the barges and dumps into the aggregate bins or to stockpiles for later transference into the steel bins by the same machine. Cement is received in bulk cement cars on the Central railroad with a spur track next to the cement bins. A 300-bbl. car is unloaded in one hour.

Ample Bin Capacity for Aggregates

Aggregate capacity is 400 tons in four compartments, one for sand, two for aggregates and the third for special orders such as pea gravel concrete and to allow for future requirements of specifying bodies for more aggregate gradations in a particular concrete mix.

Next to the aggregate bin is a 4-compartment steel cement bin of 1200-bbl. total capacity. Four compartments were considered necessary, setting aside two for standard portland and high early strength cements

View of new ready mixed concrete plant. Railroad car discharges bulk cement which is elevated into bins (center). Bin-dicators near top of each cement compartment give warning when the bin is nearly full

Above: Charging one of the truck mixers. On right, car is unloading bulk cement into a screw conveyor feeding bucket elevator. Below: Both cement and aggregates are released simultaneously from their respective batchers through a common loading chute

and the other two for special cements or purchasers' tested cements. There seems to be a tendency for more storage capacity to provide test bins, which is a parallel to requirements placed on cement mills for a similar purpose. In the older concrete batching plant these provisions were lacking and the total capacity was only 750 bbl. Storage bin space (auxiliary) was on the ground level which necessitated re-handling, while the new bin is elevated.

Electric Interlocking for Bulk Cement Handling System

Incoming bulk cement cars are spotted over a discharge hopper, and the cement is conveyed into the overhead bins by an inclined 10-in. diameter screw conveyor feeding into the boot of a 51-ft. 6-in. chain bucket elevator which in turn discharges into a 12-in. diameter distribution screw conveyor over the bins. A 10-in. diameter screw conveyor has sufficient capacity to handle cement at the desired rate of speed, but a 12-in. diameter spiral was specified for the elevator discharge overhead to insure its ability to handle any possible surges.

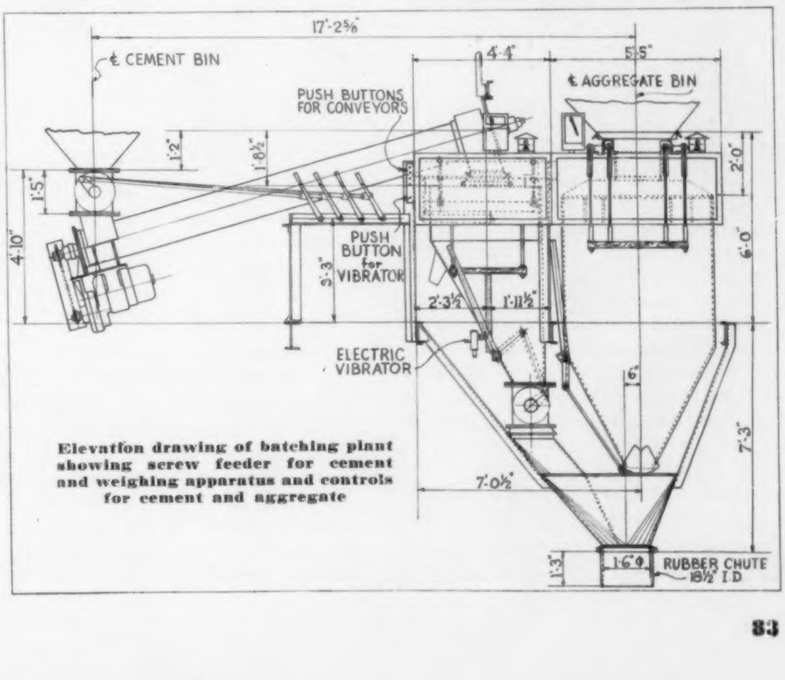
The 12-in. conveyor extends over four parallel compartments and is fitted with 14-in. Blaw-Knox rotary cement valves, controlled by chains extending to the ground below where the man in charge of unloading the car is stationed. The motor drive for this conveyor and a second one driving both the conveyor below and the elevator are interlocked electrically. If the top conveyor stops for any reason, the others automatically stop feeding cement.

In handling 300 bbl. of cement per hour from a car, past experience showed the need for some safeguard against overflowing the bins, so each compartment was equipped with a Bin-dicator. These level indicators, which warn the car operator that the bin is almost filled to capacity, are located near the top of each bin. As the bin is filled to that level, an electrical contact is completed and a bell sounds at the switchbox next to the car below. When the bell sounds, the operator knows that the bin has 25 bbl. remaining capacity or that five minutes will fill it. Contrary to usual practice, the elevator boot and drive is not below grade which is a safeguard against the entry of water. The elevator rated capacity is 50 tons of material per hour.

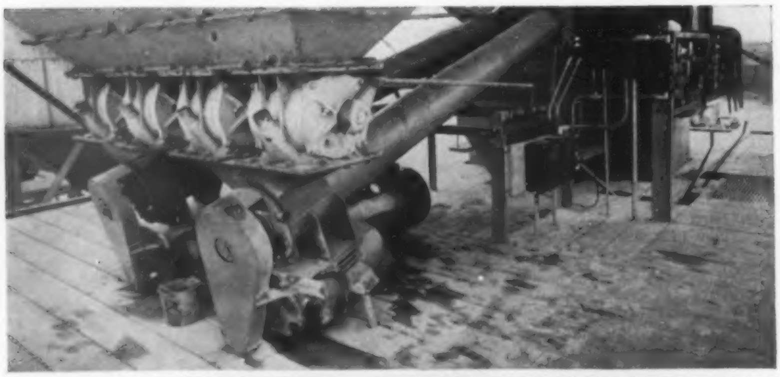
Batching Equipment

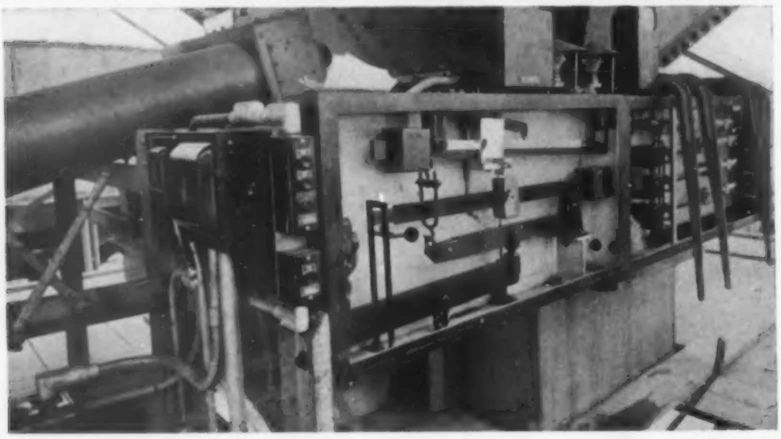
Below the cement and aggregates bins is the batching equipment for loading materials into transit mixers and the operator's station. At his convenience are the necessary scales and devices to discharge a 3-cu. yd. batch of concrete in about 45 seconds. Charging is done by weighing out cement separately in one 40-cu. ft. batcher and aggregates in a 210-cu. ft. batcher—both discharging simultaneously through a common loading chute into the top of the mixers.

Cement is released from the desired cement bin into 12-in. diameter inclined screw feeders which discharge into the weigh hopper through a dust-covered connection. Two adjacent cement bins are served by a single screw feeder, with the cement



Elevation drawing of batching plant showing screw feeder for cement and weighing apparatus and controls for cement and aggregate





Above: Valves which release cement (one for each bin) into screw feeders which discharge into concrete batcher. Note enclosed motor drive and small air compressor to aerate bins above valves. Below: Controls and operating mechanism. Scales in center are for cement received into the weigh batcher from inclined feeders, on left. To the extreme right are the aggregate scales

released into the feeder through a 12-in. Blaw-Knox rotary valve under each bin. The feeders (screw conveyors) are independently driven and are equipped with flushing governors. Cement valves, operated by levers at the batching scales, are thrown by the operator, according to the type of cement required.

Operating procedure in weighing out materials is very positive and accurate. The cement batcher is of the manual-type with automatic cut-off and push-button control. Having opened the proper cement valve, the operator sets the poise on the cement weighing scale, presses a button which starts the feeder and when the required cement is in the batcher the feed is automatically cut off. The beam scale has an indicator and a mercoid light attachment whereby a bulb flashes, showing the cycle to be completed. As is the case with the efficient handling of any supposedly free-flowing, bulk material from a bin, provision had to be made to prevent arching and to stimulate the flow into the feeders.

Directly above the feeder cement valves, air lines are tapped into the bins at a number of equidistant points and air is introduced under 150 p.s.i. pressure when necessary, by a turn of a valve. The necessity for this pneumatic action is indicated by failure of a light bulb to flash, showing the flow of cement to be obstructed. A small compressor (Kellogg Compressor and Manufacturing Corp., Rochester, N. Y.) driven by a 1-h.p. motor through V-belt develops the air pressure and automatically cuts in when the pressures drop to a definite figure. To break up arching in the bins, the operator can also alternately open and close the valves through use of his remote control levers. Similarly, the 4-beam, manual-type, aggregate batcher has flashing light bulbs to indicate when each aggregate is weighed out.

Wear Plate on Batcher Saves Replacements

Cement and aggregates, from their respective weigh batchers, discharge simultaneously through a loading chute below. By push button, the operator starts a Syntron electric vibrator attached to the cement hopper side to give complete discharge. Normal procedure is to weigh out aggregates while the cement is automatically weighed.

All the motor drives are Master geared-motors, which are dust-tight and water-tight, the drives are Link-Belt silent chain and the screw conveyors, screw feeders and bucket elevator were manufactured by Link-Belt Co. A 15-h.p. motor drives the elevator and 10-in. screw conveyor feeding it; a 5-h.p. motor drives the conveyor which fills the cement bins; and a 7½ h.p. unit drives each of the cement batcher feeders. The aggregate weigh batcher has a double-thickness of ¼-in. steel plate; the inner one which is screwed to the other is a wear plate and replaceable. Impact and abrasion from aggregates at the old plant necessitated replacement of the weigh batcher every two years.

Driveways beneath the batching plant are of reinforced concrete and the plant is supported on 65 piles driven into the mucky subsoil to a depth of 25 ft. to shell-rock. The plant structure is entirely of steel, which ultimately will be enclosed, and a laboratory for the determination of aggregate moisture content, gradation, etc., is to be installed on top. An outside commercial laboratory now performs these tests.

Ten truck mixers of 2- and 3-cu. yd. mixer capacities comprise the delivery equipment. These machines, Rex "Motomixers" and Blaw-Knox "Trukmixers," are mounted on Mack and Autocar truck chasses. Two men perform all the plant operations—one on the batching floor and the watchman who unloads cement cars on his regular shift.

Mixing water is handled independent of the new plant, with two hoses provided so there will be no delay. A 2000-gal. tank of water, heated to 120-130 deg. F. by a steam boiler plant is to be used for operation in freezing weather and aggregates, par-stockpiles. A series of 1½ in. steam pipe with perforations to release steam are staggered over the stockpile area. This method is considered preferable to applying heat in the bins due to rust formation.

While principal operations in Elizabeth have been transferred to the new plant, the older plant is used for batching out occasional special orders, such as cinder concrete, the company also operates a third plant, with four truck mixers, at Plainfield, N. J.

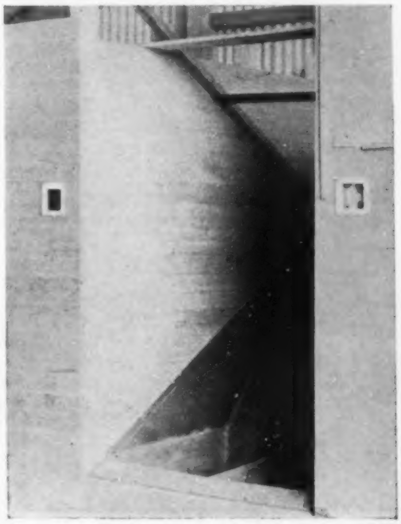
Officers of the company, aside from Mr. Dankel, are: C. E. Loizeaux, president; J. Harold Loizeaux, vice-president and treasurer; and Parker Loizeaux, secretary.

Tile From Rock Asphalt

Huge press makes 1600 tile per hour using finely ground, natural rock asphalt of a special grade

By ROBERT A. HARKER*

FINELY GROUND ROCK ASPHALT under pressure of 5000 p.s.i. in a specially designed machine takes the form of a new product, a dry-pressed mastic tile. Essentially the same material is used by the Calrock Asphalt Co., Santa Cruz, Calif., as in the natural rock asphalt paving material known as Calrock, except a special grade and finer ground material is used.



Two indicator lights, one on each side of chute, turn on automatically when the mix reaches a certain height in the chutes over the press, preventing clogging

A specially-designed roll jaw crusher reduces the stone to size and a pug mill mixer produces the mix used in the operation (see ROCK PRODUCTS, pp. 44-46, August, 1938). This material, after milling and mixing, is hauled in dump trucks to the upper floor of the press building and dumped onto the steel floor, to prevent splinters in the tile. The mix is then shoveled by hand over a screen into two chutes leading to the press charger.

In order to prevent clogging of the chutes, a pair of red indicator lights in circuit with two mercoid switches on each chute tells when the chutes are full enough to feed properly and still not clog. This prevents uneven feed, which would cause light tiles due to insufficient charging.

How Tile Press Operates

The charger, below the chutes, moves over the mould boxes, fills them and strikes off level on the return stroke. These operations are the same as in any standard dry brick press. Four top plungers come down by the action of the toggle and press the charge; they rise and then the four lower plungers (bottoms of the four mould boxes) come up till they are flush with the table of the press, bringing the four compressed tile up so that the next forward stroke of the charger pushes them forward within easy reach of the two press operators. The tile are picked off carefully, since they are quite fragile before ageing, and are placed on pallets which are stacked on skids for easy handling by Yale lift trucks. The operation is continuous; a new skid is switched in as soon as a loaded one leaves for the storage area.

The cycle of the press is 9 seconds for four tile, therefore, theoretically, the press will produce 1600 tile per hour, but a safe, conservative estimate would be 1300 per hour.

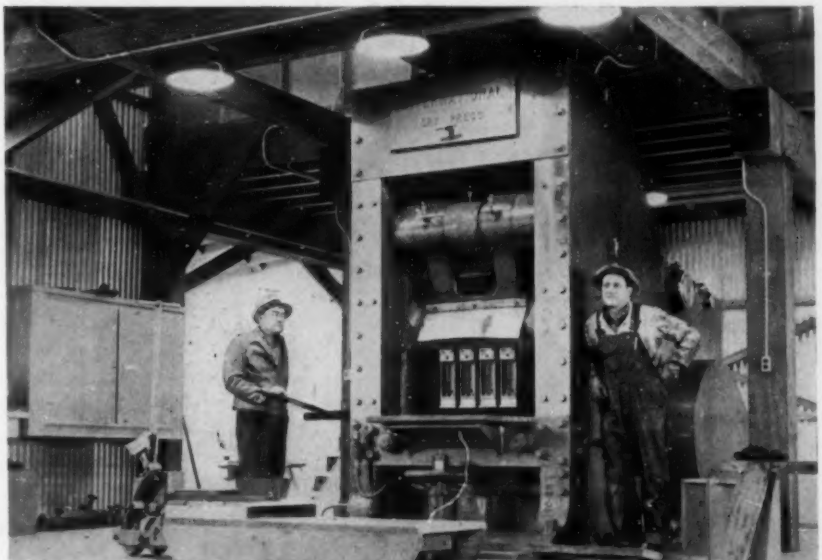
Mastic tile are tested frequently as they come off the press for uniformity of weight and thickness with accurate scales and a micrometer.

Store Tile for Month To Harden

After leaving the press the tile are stored under cover for air drying for about one month, after which time they become quite hard and easy to handle. They are then packed in boxes.

All handling of the tile, pallets, and boxes is by the skid lift truck system, which eliminates costly hand work. The packed boxes are also rolled to box cars or trucks on the lift trucks. The lift trucks will move a load of over two tons with ease on the smooth floor.

The press is a specially designed job by the International Clay Machinery Co., and is, in general, similar to a clay



Large press which produces mastic tile under a pressure of 5000 p.s.i., using crushed rock asphalt material

*Plant Superintendent, Calrock Asphalt Co., Santa Cruz, Calif.

Lift truck and load of newly made tile on curing trays

dry press except it is larger and capable of greater pressures up to 5000 p.s.i

Asphalt mastic tile are used for paving industrial floors, roof decks, and similar places where a durable pavement of ready pressed tile is required. Outstanding advantages of these tile are: durability, good insulating qualities, good sound deadening and easy on the feet, resistance to chipping and non-skid even when wet, good appearance and ease of installation. They measure 1- x 4¾- x 9½-in., and are available in red or natural color. They can be finished in a variety of lustres. These tile are the result of a number of years of experimental work on the part of the Calrock Asphalt Co., in the laboratory, in various dry presses, and on the job. The installation of this new heavy duty press will produce even a better and more dense tile than have been made in the past, during the period of development.

Large Structure Market

(Continued from page 80)

Racks of freshly-manufactured blocks are conveyed into two steam curing kilns by a Clark "Truclift," and are similarly handled into stock. Curing capacity is about 2000 block.

Normal inventory carried in stock is 40,000 to 50,000 concrete block, with a minimum curing period of 28 days before delivery. In addition to direct sales, a contractor and dealer business has been developed, embracing a shipping radius of about 75 miles. Ray W. Darden supervises production while most of Mr. Bailey's time is spent in the field.

EMIL SCHMELLER, Chewelah, Wash., has been granted a patent for a concrete wall structure. With this wall, a new type of building block is used in which the hollow core is employed as part of the heating system of the house, providing an indirect heating unit. The wall will be made in complete sections and hauled to the site.

Chicago Contractor Wants Ready Mixed Concrete

GERHARDT F. MEYNE, Chicago contractor, in testimony before the Temporary National Economic Committee hearings on building costs, charged that certain labor unions had made it impossible to use ready mixed concrete in Chicago. He said that on small home construction in this city "we have to haul the mixer and equipment to the job, set it up, and then transport the concrete to the work in the old-fashioned way of 30 years ago with a wheelbarrow."

Concrete Pipe Branch

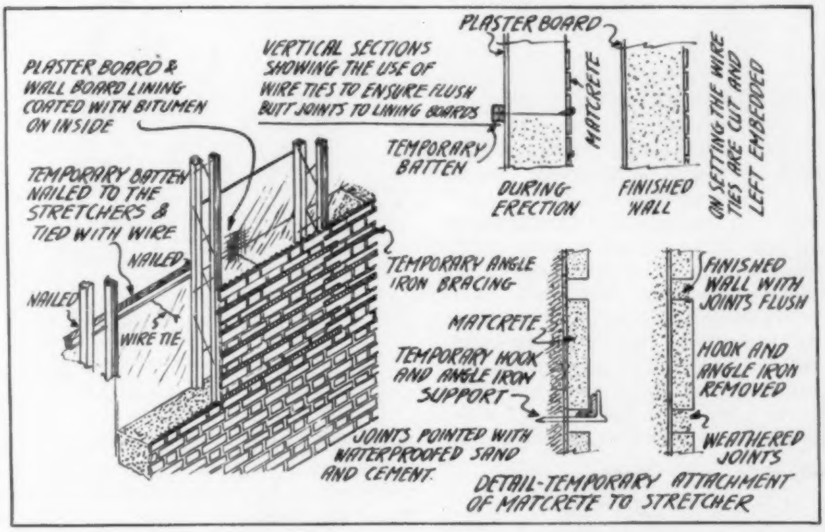
THE UNIVERSAL CONCRETE PIPE CO., INC., operating a factory at New Martinsville, W. Va., will establish a new plant at South Parkersburg, according to Sam Buderman, company official. The new plant will employ 25 men.

THE FEHR CONCRETE PIPE CO. plant at Ladysmith, Wis., is now ready for operation, and will be in charge of Clyde Meindel, Emil Fehr, operating a similar plant at Eau Claire, Wis., is owner of the plant.

Solid Concrete Wall Faced With Bricks On One Side

SOMETHING new in house construction has been developed and patented in England which comprises a solid concrete wall faced on one side with precast concrete bricks. The unit of construction is a flexible mat of 40 concrete bricks ½ in. thick cast on a base of legs of the stretchers. On completion of the wall these bolts are withdrawn and the lengths of angle iron are taken down ready for use in a similar manner.

While the stiff mixture of concrete is being poured in the form, some of it passes through the ½-in. joints between



Details of "Matcrete" construction with concrete brick faces cast into concrete wall

wire netting, and arranged with ½-in. vertical and horizontal joints between the bricks. To obtain different color effects, the bricks may be finished with crushed burnt clay or a facing of colored sand. With Matcrete construction, as it is called by *Concrete Building and Concrete Products*, London, England, the mats can be packed flat or rolled in bales for transport, and each mat can be handled by one man.

These mats of concrete bricks are used as the outside wall form and are fastened to vertical steel or wood stretchers. A wood stretcher consists of two lengths of timber which are spaced apart to suit the thickness of the wall and are braced together with iron dogs. When in position, one leg of the stretcher is in contact with the wire mesh behind the precast mat, and the other leg is flush with the line of the inner face of the concrete to be poured in place in the wall. On the inside of the wall, the form comprises plaster board backed with bitumen and nailed to the stretcher legs on that side of the wall.

To hold the mats in position while the back-up concrete is being poured, angle irons, ½-in. by ½-in. in section, are set horizontally to support the lower edge of the bricks in a course. They are carried on hook bolts driven into the front the precast concrete bricks and keys the poured concrete with the bricks.

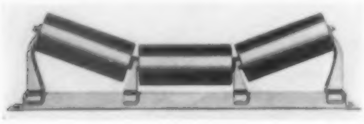
An interesting method is employed to tie the mats into foundations. When the trenches for the footings have been excavated, spikes are driven in the bottom. These spikes are 14 in. apart, depending upon the wall thickness required, and are used in the following way:

A mat is fastened to the outer row of spikes so that its bottom edge is about 12 in. above the bottom of the trench; expanded metal or plaster board is similarly fastened to the inner row of spikes.

NEW MACHINERY ✶ ✶ NEW EQUIPMENT

Idler for Handling Light Materials

CHAIN BELT CO., Milwaukee, Wis., has developed a ball-bearing idler, designated as type B-304, for handling materials of medium weight consisting of fines and small lumps. It is suitable for conveyor widths of 14 in. to 30 in. inclusive. The idler rolls are made from 4 in. diameter smooth finished steel tubing with formed heads pressed into and welded to each end. The heads are ball-bearing equipped with effective sealing against dust and dirt by a combination labyrinth and composition seal. The rolls are rounded and smooth to prevent injury to conveyor belt and may quickly be removed.



Ball-bearing conveyor idler for handling light materials

Self-Regulating Battery Charger

GENERAL ELECTRIC CO., Schenectady, N. Y., has brought out a completely automatic and self-regulating electronic battery charger called the Phano-Charger. By using industrial-type metal phanotron rectifier tubes, moving parts are eliminated thus assuring long life for the equipment and practically silent operation. The chargers are available in three sizes: 4.5 amperes and 12.5 amperes to operate from a single-phase power supply, and 25 amperes to operate from a three-phase a-c supply.

The Phano-Charger is readily adjustable over a wide voltage range, making it possible to trickle-charge a fully charged battery. The rectifier will then automatically furnish more current up to the safe current limit of the tubes when the battery-terminal voltage is diminished. This adjustment is also useful in stepping up the charging rate in the event the battery has become discharged on excessive overloads and must be brought back to a fully charged condition in the shortest possible time.

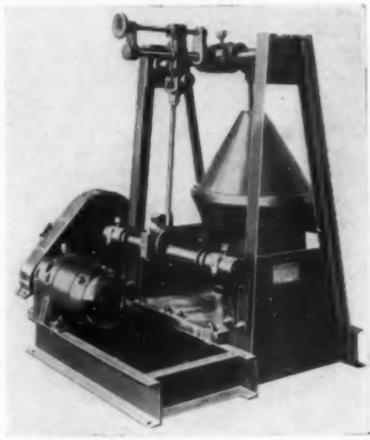
Diaphragm Pump

HARDINGE CO., INC., York, Penn., has improved the design of its diaphragm pump used to handle underflow from thickeners.

The mechanical design is such that the length of the stroke, or pump capacity, may be varied without stopping the pump, itself. The advantage of this feature is obvious in cases where even slight variations in required capacity occur.

The lower valve is of smaller diameter than the upper valve and, consequently, may be easily removed through the upper one, for examination or replacement, when abrasive pulps are being handled.

The illustration shows the general arrangement of the pump which can be obtained with a motor drive unit, or arranged for belt drive. These pumps have been installed with rubber covering on the pump body and valves, or of some special material construction, for the handling of corrosive mixtures.



Pump for handling under-flow from thickeners is designed so that the length of stroke may be varied without stopping the pump

Screen Cloth Made With Piano Wire

JEFFREY MANUFACTURING CO., Columbus, Ohio, has introduced a new type of screen cloth made of piano wire which is unusual in that the wires run in one direction only with no cross wires.

This screen cloth is stretched to such a high tension that the individual wires develop a resonance said to have the peculiar property of passing undersize particles very rapidly.

Left: Controlled rectifier for battery charging service

Right: Piano wire cloth applied to an electric vibrating screen

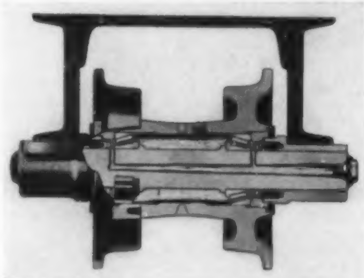
In addition, the manufacturer claims that this piano wire has much greater capacity and longer life, with almost complete freedom from blinding.

At present this cloth is made in meshes from ⅜-in. to 120-mesh, and can be furnished in stainless steel if desired.

Track Roller Requires Little Lubrication

ALLIS-CHALMERS MANUFACTURING Co., Milwaukee, Wis., has announced a positive-seal truck wheel assembly for tractors which it is claimed will eliminate daily roller greasing.

In this truck wheel assembly, ordinary bearings are replaced by tapered roller bearings with a positive-seal arrangement that keeps in lubricating oil and keeps out dirt, dust, mud and grit. Lubrication, according to Allis-Chalmers engineers, is re-



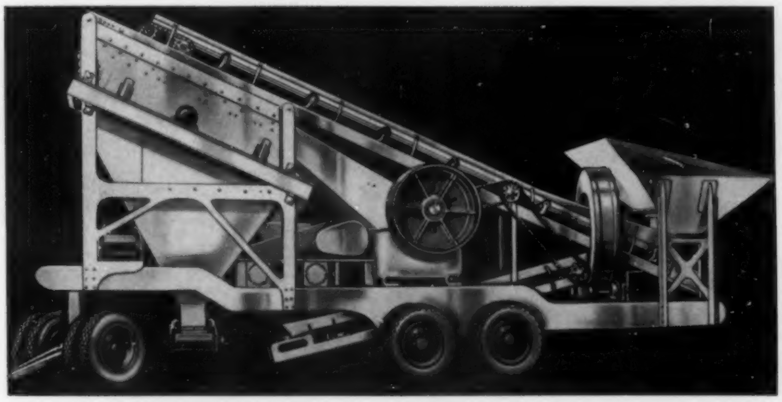
Truck wheel assembly for tractors which is sealed against entry of dirt and requires infrequent lubrication

quired only once every 200 operating hours instead of every eight hours as heretofore. It is so constructed that all of the old oil is forced out each time the assembly is lubricated. Thus the user is doubly protected against abrasive grit working into his track assembly.

Turbine-Type Elevator On Crushing Plant

UNIVERSAL CRUSHER Co., Cedar Rapids, Iowa, has introduced a new model dual crushing plant in which the belt conveyor return system for feeding back material from both the primary jaw crusher and the secondary crushing rolls, has been changed. This equipment has been replaced by a new turbine type revolving elevator called the Rotavator which conveys material discharged into it by the under crusher return conveyor to the screen feed conveyor directly above the latter.

Savings in weight, overall length and width resulting from the use of the Rotavator are said to provide a far lighter, more portable unit and to shorten the cycle, speeding up production.

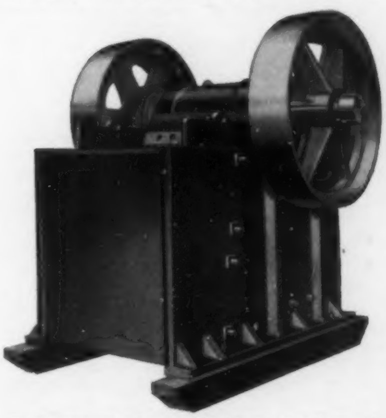


Portable crushing plant with turbine type revolving elevator which conveys material discharged by crusher to the screen feed conveyor

Other equipment includes: a 2½ deck 3- x 8-ft. screen, hopper and grizzly, feeder, sand ejector, 10- x 36-in. lightweight crusher, and 30- x 18-in. rolls.

Jaw Crusher for Either Stationary or Portable Use

THE IOWA MANUFACTURING Co., Cedar Rapids, Iowa, is placing a specially designed large-capacity "Cedar Rapids" jaw crusher on the market. This primary crusher, with a



Primary crusher with jaw opening of 25- x 40-in.

jaw opening of 25- x 40-in., is designed and built to take big rocks direct from the quarry, thereby reducing the amount of intermediate breakage, drilling, dynamiting, and secondary shooting normally necessary. The manufacturer claims this equipment can be fed directly by a 1¼-cu. yd. shovel. It is said that large rocks are less apt to bridge and stop the feed because a narrow angle nip assures continuous downward travel of rock in the jaws and eliminates slippage and "climbing."

With a jaw opening of 1000 sq. in., this crusher has rated capacities of from 75 to 125 tons per hour producing 4-in. material; 100 to 150 tons per hour reducing to 5-in. product, and 125 to 175 tons per hour, crushing to 6-in. size. Weighing only 34,000 lbs., this crusher is within the weight limits of the portable and stationary quarry operators. It has an electrically welded reinforced steel plate frame. This design reduces weight without sacrificing rigidity, strength, or durability.

Power Shovel Has Fast Crowd-out and Retract

BUCYRUS-ERIE Co., South Milwaukee, Wis., has developed a 2-cu. yd. power shovel, the 44-B, which is available with gasoline, diesel, or electric power and can be converted for use as shovel, dragline, clamshell, or crane.

A new type chain crowd has been incorporated into the 44-B, which according to the manufacturer, will provide powerful crowd-out and high speed retract, saving time on every digging cycle. Crowd, hoist, and swing

Convertible shovel of 2-cu. yd. capacity has chain crowd with powerful crowd-out and high speed retract

are synchronized to give maximum output in all kinds of digging.

Special attention has been given to the dipper. A short back, curved door, and smooth inside which flares outward to the bottom all assure fast, clean dumping action.

Traffic and Transportation

PROPOSED RATE CHANGES—The following are the latest proposed changes in freight rates up to and including the week of July 15:

Central

58566. Establish on sand (except in closed equipment C. L., and in open top equipment, C. L. (see Note 6), from so-called Vassar Group, viz.: Vassar, Wampson, McHale, Juniata and Watrousville, Mich., to Lancaster, N. Y., 237c in open top cars and 242c per net ton in closed cars.

58607. Establish on sand (except industrial) in open equipment. C. L.(see Note 3), McCormic (Chicago), Ill. (ex lake) to Indianapolis, Ind., 160c per net ton.

58637. (2)—Establish on (a) sand, industrial, in all kinds of equipment, C. L.; sand (except industrial), in closed equipment, C. L.; (b) sand, ground or pulverized, in all kinds of equipment, C. L.; (c) sand (except industrial) in open top equipment, C. L. (see Note 6), from Copley, O., to destinations in Pennsylvania.

Destination (representative)	Proposed rates A	B	C
Argentine	176	194	154
Conneaut Lake Park	165	182	143
Indianola	176	194	154
Linesville	165	182	143
Muse	165	182	143
North Star	176	194	154
Atlasburg	154	169	132
Atlantic Colliery No. 2	187	206	165
Bitner Colliery	198	218	176
Cecil	165	182	143
End Andrews Run Br.	176	194	154
End Lyons Run Br.	176	194	154
End Street Run Br.	165	182	143
End Tearing Run Br.	198	218	176
End Unity Branch	187	206	165
End Yellow Creek Br.	198	218	176
Lincoln Colliery	187	206	165
Seehart Colliery	176	194	154
South Union Colliery No. 1	198	218	176
Yukon Colliery	187	206	165
Yough Colliery	176	194	154
Pittsburgh West End	165	182	143

58638 (2)—Establish on sand, all kinds and to destinations in Ohio as follows (Rates in cents per net ton): To Akron, 94; Alliance, 99; Barberton, 88; Bellefontaine, 112; Bellevue, 105; Berea, 105; Bucyrus, 99; Canton, 88; Chagrin Falls, 110; Chillicothe, 160; Cincinnati, 171; Columbus, 127; Crestline, 88; Dayton, 149; Deshler, 127; East Liverpool, 116; Elmore, 127; Findlay, 116; Fostoria, 110; Fredericktown, 99; Fremont, 116; Galion, 94; Gallipolis, 160; Geneva, 138; Hillsboro, 171; Ironton, 237; Kent, 99; Lorain, 110; Marion, 105; Martins Ferry, 127; Miamisburg, 149; Minster, 138; Newcomerstown, 110; Orrville, 72; Painesville, 127; Sandusky, 110; Steubenville, 116; Toledo, 127; Van Wert, 138; Wadsworth, 88; Warren, 116; Willoughby, 116; Youngstown, 116; Zanesville, 116.

58627. Establish on sand, all kinds, and gravel, in open top cars, C. L., Belpro, O., to destinations in Ohio, rates (in cents per net ton), as follows: Barnesville, 116; Barton, 116; Bellaire, 116; Belle Valley, 94; Belmont, 116; Blaine, 116; Bridgeport, 116; Brokaw, 88; Buffalo, 110; Cambridge, 105; Corning, 99; Crooksville, 105; Cumberland, 116; Dexter City, 77; Echo, 116; Flushing, 127; Glenford, 110; Greendale, 99; Guernsey, 116; Hebbardsville, 88; Holloway, 138; Hollister, 94; Hooksburg, 94; Junction City, 105; Kimbolton, 110; Lamira, 127; Logan, 99; Lore City, 110; Lost Run, 105; McClainville, 116; Martins Ferry, 116; Millfield, 88; Muskingum, 110; Modoc, 94; Moxahala, 99; Neffs, 116; New Marshfield, 88; New Stratsville, 105; Pleasant City, 99; Powhatan, 127; Quaker City, 110; St. Clairsville, 116; Saltillo, 110; Sayre, 99; Shawnee, 99; Thornville, 116; Union Furnace, 105; Warnock, 116; Wegee, 116; West Junction, 110; West Wheeling, 116; Zaleski, 94.

Sup. 1 to W. D. A. 58435. Withdrawal notice. White Docket Advice 58435, Docket Bulletin 2987, dated May 27, 1939, covering proposal to establish rate of 84c per net ton on stone, crushed, slag or gravel, coated with oil, tar or asphaltum, in open top equipment, C. L., Ashtabula, O., to Painesville, O. is hereby withdrawn from the docket inasmuch as shipper did not secure the contract.

58669. Establish on stone, crushed (in bulk), and crushed stone screenings (in bulk), in open-top cars, C. L., West Columbus, O., to C. & M. Crossing, O., 116c per net ton, via N. Y. C. R. R., Columbus, O., B. & O. R. R.

58690. Establish on sand (bank, river or torpedo) or gravel, C. L., Standard Pit, Ind., to Buckskin and Elberfeld, Ind., 85c per net ton, via C. & E. I. Ry., Terre Haute, Ind., and C. C. C. & St. L. Ry.

58771. Establish on sand, industrial, in all kinds of equipment, and sand (except industrial), in closed equipment, or in open top equipments with tarpaulin or other protective covering, C. L., respectively, Rockwood, Mich., to Oshawa, Ont., 305c per net ton, via D. & T. S. L. R. R., Detroit, Mich., Grand Trunk Western, Port Huron, Mich., Canadian National, and via D. & T. S. L. R. R., Detroit, Mich., Canadian Pacific R. R.

58691. Establish on (a) sand, industrial, C. L.; sand (except industrial) in closed equipment, C. L. (b) Sand, ground or pulverized, in all kinds of equipment, C. L. (c) Sand (except industrial) in open top equipment, C. L. (see Note 6), Copley, O., to Ebenezer, N. Y.: (a) 220c; (b) 242c, and (c) 204c per net ton.

58692. Establish on (a) sand, industrial, in all kinds of equipment, C. L.; sand (except industrial) in closed equipment, C. L.; (b) sand, ground or pulverized, in all kinds of equipment, C. L.; (c) sand (except industrial), in open-top equipment, C. L. (see Note 6), Zanesville, Ohio, group to Cabin Creek Jct., W. Va.: (a) 187c; (b) 206c, and (c) 165c per net ton.

58700. Establish on limestone, crude, fluxing, foundry and furnace when loaded in bulk in open top equipment, C. L., to Neville Island, Penn., from Engle and Martinsburg, W. Va., 116c per gross ton, via B. & O. R. R., Demmler Trf., Penn., P. & L. E. R. R.

58701. Establish on chatt sand, C. L. (See Note 3), but orders will not be accepted for closed and open top cars of less marked capacity than 60,000 lb. and 80,000 lb., respectively (see note), E. St. Louis, Ill., to McDermott, O., 308c per net ton.

Note—When a shipper orders a car of above mentioned marked capacities or greater and the carrier is unable to furnish car ordered and furnishes a car of greater capacity than that ordered, the min. wt. for the car furnished will be that which would have obtained had the car ordered been furnished and used.

58747. (a) Establish on agricultural limestone, unburnt, in bulk, in open top cars, C. L., Durbin, O., to Cincinnati, O., 77c per net ton. (b) Establish on stone dust, C. L., Durbin, O., to Cincinnati, O., 111c per net ton. Route: Via C. C. C. & St. L. Ry. direct.

58755 (2). Establish on crushed stone and crushed stone screenings, C. L., Wabash, Ind., to Ft. Wayne, Ind., 55c per net ton, to expire Dec. 20, 1939.

58780. Establish on fluorspar, in packages or in bulk, C. L., ex-river, min. wt. 40,000 lb., from points in Pittsburgh District to Ansonia, Conn., 528c; Bethlehem, Penn., 440c; Buffalo, N. Y., 374c; Cranston, R. I., 572c; Conshohocken, Easton, Eddystone, Penn., 440c; Harrison, N. J., 484c; Phillipsdale, R. I., 572c; Reading, Penn., 396c; Schenectady, N. Y., 484c; Steelton, Penn, 374c; Totenville, N. Y., 484c, and Worcester, Mass., 572c per net ton, via usual available routes.

58807. Establish on stone, fluxing, furnace or foundry, melting or refractory (unburned), in bulk, in open top cars, C. L., Carey and McVittys, O., also other Northwestern Ohio Group 1 origins if desired, to Painesville, O., 116c per gross ton.

58905. Establish on sand, all kinds, and gravel, in open top cars, C. L., Zanesville (Fair Oaks), O., to Guysville, O., 99c per net ton.

58980. Establish on sand (except industrial) and gravel, in open top cars, C. L., Tecumseh, Mich., to Woodville, O., 101c per net ton.

58848. Establish on stone, crushed, slag or gravel, coated with oil, tar or asphaltum (see Note 7), in open top cars, in straight or mixed C. L., Donora, Penn., to points in Pennsylvania, representative rates as follows: (Rates in cents per net ton to representative P. R. R. stations): Lilly, 135; St. Michael, 135; Ashtola, 135; Seward, 124; Torrance, 113; Crabtree, 102; George, 102; Jeannette, 91; Gratztown, 102; Cribb, 102; Humphreys, 102; Moyer, 102; Walnut Hill, 91; Hutchinson Siding, 91; Monongahela, 80; Ontario Colliery, 80; Grindstone, 91; Brownsville, 80; Graceton, 113; Avonmore, 102; Hyde Park, 102; Creighton, 113; Cheswick, 102; Oakmont, 91; Logansport, 113; Kittaning, 113; Bostonia, 135; Dixmont, 102; Beaver Falls, 113; Crescentdale, 113; Glanford, 91; Gladden, 102; Oakdale, 102; Langeloth, 113.

Note 1—Minimum weight marked capacity of car.

Note 2—Minimum weight 90% of marked capacity of car.

Note 3—Minimum weight 90% of marked capacity of car, except that when car is loaded to visible capacity the actual weight will apply.

Note 4—Reason: No present or prospective movement.

Note 5—Reason: Comparable with rates from other origins in immediate vicinity.

Note 6—Rates will not apply on shipments in cars with tarpaulin or other protective covering. In such instances the rates applicable on shipments in box cars are to be assessed.

Note 7—The oil, tar or asphaltum not to exceed 10% of weight of the commodity shipped, the shipper to so certify on shipping order or bill of lading.

58759. **Establish on stone, crushed, slag or gravel, coated with oil, tar or asphaltum** (see Note 7), in open top cars, in straight or mixed C. L., Weirton, W. Va., to pts. in Pennsylvania, rates as follows:

	Prop. Rates		Prop. Rates
To B. & O. Stations in Penn.		Mt. Pleasant	/124
		Connellsville	/124
West Newton	*130	Dunbar	/135
Claysville, Pa.	*119	Uniontown	/135
West Alexander	*119	Fairchance	/135
Allison Park	†119	Homestead	/102
Karns City	†151	McKeesport	/102
Marion Centre	†161	West Elizabeth	/113
Zelienople	†130	Bentleyville	/124
To Monongahela R. R. Stations in Penn.		Charleroi	/124
		W. Brownsville	/124
		Blairsville	/135
Masontown	‡151	Homer City	/135
Monongahela	‡151	Indiana	/135
To P. & L. E. Stations in Penn.		Avonmore	/124
		Apollo	/124
Monaca	§130	Leechburg	/113
West Newton	¶130	Freeport	/113
To P. R. R. Stations in Penn.		Sarver	/113
		Marwood	/124
Cherry Tree	/157	Butler	/124
Seward	/135	Brackenridge	/113
Bolivar	/135	Harmarville	/102
Latrobe	/124	Aspinwall	/102
New Alexandria	/124	Oakmont	/102
Greensburg	/113	New Kensingt'n	/113
Jeannette	/113	Braeburn	/113
Irwin	/113	Kittanning	/124
Export	/113	Rimerton	/135
Braddock	/102	Ambridge	/113
Swissvale	/102	Baden	/102
		New Galilee	/113

* Via P. R. R.-Wheeling, W. Va.-B. & O.

† Via P. R. R.-New Castle, Penn.-B. & O.

‡ Via P. R. R.-Brownsville Jct., Penn.-Mon.

§ Via P. R. R.-Beaver Falls, Penn.-P. & L. E.

¶ Via P. R. R.-Homestead Tfr., Penn-P. & L. E.

/ Via P. R. R. direct.

58850 (2). Establish on (a) **sand and gravel**, C. L., Wolcottville, Winona Lake, Kenneth and Lake Ciecott, Ind., to Valparaiso, Ind., and (b) **crushed stone**, C. L., Logansport and Kenneth, Ind., to Valparaiso, Ind., 61c per net ton.

58904. Establish on **sand** (except industrial), and gravel, C. L., Cayuga, Ind., to Frankfort, Ind., 55c per net ton.

Trunk

37617, Sup. 3. **Ground limestone**, C. L., min. wt. 60,000 lb., to Sherbrooke, Que., from Bridgeport, Cedar Hollow, Plymouth Meeting, Penn., etc., 694c per net ton and from Annville, Lebanon, Palmyra, Penn., etc., 705c per net ton: to Windsor, Ont., from Bridgeport, Cedar Hollow, Plymouth Meeting, Annville, Lebanon, Palmyra, Penn., etc., 575c per net ton. From Bittinger, Rambo, York, Thomasville, Penn., and Texas and Cockeysville, Md., to Windsor, Ont., 572c per net ton. From Lime Crest, N. J., to Montreal and Granby, Que., 599c per net ton, to Quebec, Que., 779c per net ton and to Sherbrooke, Que., 650c per net ton, and to Windsor, Ont., 550c per net ton. (See Note 5.)

37852. **Crushed stone and screenings**, in straight or mixed C. L. (will not include agricultural limestone or ground limestone, unburnt, fluxing stone or firestone, or stone, coated with oil, tar or asphaltum), (See Note 3), from Woodberry (Baltimore), Md., to Curtis Bay (Baltimore), Md., 88c per net ton. (See Note 5.)

37856. **Crushed stone and screenings**, in straight or mixed C. L. (will not include agricultural limestone or ground limestone, unburnt, fluxing stone or firestone; or stone, coated with oil, tar or asphaltum), (See Note 3), from Monocacy, Penn., to Cape Charles, Va., $1.98 per net ton and to Richmond, Va., $2.31 per net ton. (See Note 5.)

37857 (increase). Cancel following commodity rates on coated **crushed stone**, C. L., from Stafford, N. Y., as published on page 68 of Erie R. R. Tariff I. C. C. 19773: To Marienville, Penn., 143c; Chaffee, Penn., to Nansen, Penn., 132c; Durant City, Penn., 154c; Jo-Jo Jct., Penn., to Griffiths, Penn., 132c. (Rates in cents per net ton.) (See Note 4.)

37864. **Limestone**, crude, fluxing, foundry and furnace, when loaded in bulk in open top equipment, C. L., from Engle and Martinsburg, W. Va., to Neville Island, Penn., 116c per gross ton. (See Note 5.)

37864 (Sup. 1). **Limestone**, crude, fluxing, foundry and furnace, when loaded in bulk in open top equipment, C. L. (See Note 3), from Inwood, W. Va., to Neville Island, Penn., 128c per gross ton, in lieu of current commodity rate of 151c per gross ton.

37866. **Sand** (other than industrial) and **gravel**, in open top cars without tarpaulin or other protective covering, C. L. (See Note 3), from Cleveland, N. Y., to Auburn, N. Y., 121c per net ton, in lieu of current commodity rate of 154c per net ton.

37867. **Sand** (other than industrial) and **gravel**, in open top cars, without tarpaulin or other protective covering, C. L. (See Note 3), from Cleveland, N. Y., to Ithaca, N. Y., 154c per net ton, in lieu of current sixth class rate of 360c per net ton.

37890. **Blocks and tiles** (non-ornamental), made of sand and cement, cinder and cement, slag and cement or slag, sand and cement, C. L., min. wt. 60,000 lb., from Arlington, Md., to Frostburg, Md., 297c per net ton, in lieu of current sixth class rate of 22c per 100 lb.

37908. **Stone, natural** (other than bituminous asphalt rock), crushed, with or without coating of oil, tar and/or asphaltum, C. L. (See Note 3), from Jamesville, N. Y., to Carbondale, Penn., 143c per net ton, in lieu of current commodity rate of 165c per net ton.

37917. **Slag** (product of iron or steel, blast or open hearth furnaces), not ground or pulverized, coated with oil, tar or asphaltum, in bulk in open top equipment in straight C. L. The oil, tar or asphaltum not to exceed 10% by weight of the commodity as shipped, the shipper to so certify on shipping orders and bills of lading (See Note 3), from Sparrows Point, Md., to (proposed rate per net ton): Wilmington, Del., 124c; Croome, Md., 113c; State Road, Del., 124c; Bear, Del., 124c; Porter, Del., 124c; Porter, Del., 124c; Kirkwood, Del., 124c; Mt. Pleasant, Del., 124c; Armstrong, Del., 124c; Middletown, Del., 124c; Lambson, Md., 135c; Black, Md., 135c; Barnes, Md., 168c; Old Pt. Comfort, Va., 209c; Norfolk, Va., 220c; Portsmouth, Va., 220c; Plantation, Va., 209c; Hunts, Va., 209c; Capeville, Va., 209c; Cedar Grove, Va., 209c; Townsend, Va., 209c; Latimer's, Va., 209c; Kiptopeke, Va., 209c. (See Note 5.)

37944. **Feldspar**, C. L., from Brookneal and Bedford, Va., to Abingdon, Alton, East St. Louis, Granite City, Macomb, Monmouth, White Hall, Ill., and St. Louis, Mo., 560c per net ton. (See Note 4.)

37932. **Fluorspar** in packages or in bulk, C. L., ex-river, min. wt. 40,000 lb., from points in the Pittsburgh district, viz.: Allegheny (Pittsburgh North Side), Aliquippa, Bessemer, Colona, Etna, Glassport, Glenwood, Hays, Junction Trf. (33rd St. Station, Pittsburgh), McKeesport, Munhall (Kenny Yard), New Kensington, Pittsburgh, Rankin, Rochester and So. Duquesne, Penn.:

To Ansonia, Conn., 528; Bethlehem, Penn.,440; Buffalo, N. Y., 374; Cranston, R. I., 572; Conshohocken, Penn., 440; Easton, Penn., 440; Eddystone, Penn., 440; Harrison, N. J., 484; Phillipsdale, R. I., 572; Reading, Penn., 396; Schenectady, N. Y., 484; Steelton, Penn., 374; Tottenville, N. Y., 484; Worcester, Mass., 572. (In cents per net ton.) (See Note 5.)

Texas-Louisiana

3833. Establish following rates in cents per ton of 2000 lb. on **stone:**

From	To Beau-mont	To Port Arthur	To Orange
Jefferson, Tex.	180	190	180
Sarber, Tex.	180	190	180
Avinger, Tex.	190	190	180
Hughes Springs, Tex.	190	190	190
Veals, Tex.	190	200	190
Daingerfield, Tex.	190	190	190
Cason, Tex.	190	190	190
Pittsburg, Tex.	180	190	180

3868. Establish following rates on **feldspar** from Mica, Texas:

To	Rate Cents
Brownsville (Note A), min. wt. Note 3	489
Eagle Pass (Note A), min. wt. Note 3	489
Laredo (Note A), min. wt. Note 3	489
Shreveport, La., min. wt. 50,000 lb.	578
Corpus Christi (Notes B and C), min. wt. (Note 3	489
Galveston (Note B and C), min. wt. Note 3	489
Houston (Notes B and C), min. wt. Note 3	489
Texas City (Notes B and C), min. wt. Note 3	489
Corpus Christi (Note D), min. wt. Note 3	489
Eagle Pass (Note D), min. wt. Note 3	345
Galveston (Note D), min. wt. Note 3	489
Houston (Note D), min. wt. Note 3	489
San Antonio (Note D), min. wt. Note 3	403
Texas City (Note D), min. wt. Note 3	489
Wichita Falls, min. wt. Note 3	578

Note A—For export to Mexico.

Note B—Applicable on export and coastwise traffic as defined in Item 20 of Texas Lines' Tariff 75-C.

Note C—Does not include terminal charges, except switching.

Note D—Intrastate traffic.

Illinois

I. R. C. 7906-A. **Agricultural limestone**, from Hannibal and to the following representative points in Missouri. Present rate 66c; proposed, 55c. (Distance in miles follows each destination.)

From Hannibal, Mo., to Quincy (19.7), Fowler (30.6), Paloma (34.1), Coatsburg (36.2), Camp Point (41.3), Golden (47.1), La Prairie (49.7), Ursa (29.9), Mendon (34.9), Loraine (40.5), Augusta (56.3), Plymouth (60.4), Stillwell (45.7), West Point (48.2), Basco (53.4), Carthage (60.3), Ferris (64.3), Adrian (68), Colusa (71.4), Dallas City (76). From Quincy, Ill., to Fowler (10.9), Paloma (14.4), Coatsburg (16.5), Camp Point (21.6), Golden (27.4), LaPrairie (30), Ursa (10.2), Mendon (15.2), Loraine (20.8), Augusta (36.6), Plymouth (40.7), Stillwell (26), West Point (28.5), Basco (33.7), Carthage (40.6), Ferris (44.6), Adrian (48.3), Colusa (51.7), Dallas City (56.3).

8839 (I. R. C.). To cancel following rates on **stone, broken, crushed or ground**, account obsolete: Rates from Ottawa, Ill., to Grand Ridge, Ill., 84; Ottawa, Ill., to Richards, Ill., 84; Ottawa, Ill., to Streator, Ill., 84; Streator, Ill., to Ottawa, Ill., 97; Streator, Ill., to Grand Ridge, Ill., 97; Streaton, Ill. (when from beyond), to Grand Ridge, Ill., 69.

8853. **Gravel or sand** (common river), straight or mixed C. L. (See Note 3), but not less than 40,000 lb. (applies only on traffic moving in open cars), from Mt. Carmel, Ill. (rates per net ton) to the following Illinois points. Present rate 132c. Proposed to Hoffman, 105c; Posey, 116c; Zachary, 116c; Bartelso, 116c.

I. R. C. 8855. **Sand** (except industrial) and **gravel**, C. L. (See Note 3), but in no case will the min. wt. be less than 60,000 lbs., from Louisiana, Mo., to Jacksonville, Ill. Present—84c net ton. Proposed 69c net ton.

NEW Literature about your business

This recently published literature is available free, upon request:

Air Compressors.—Ingersoll-Rand Co. An illustrated leaflet, form 2437, describes the Ingersoll-Rand type 20 vertical, stationary, two-stage, high pressure air compressors for starting internal combustion engines.

Ball Bearings. — Stephens-Adamson Mfg. Co., Catalog 739 gives dimensions, capacities, and details of the Sealmaster line of ball bearings, pillow blocks, flange units, and take-up units.

Belting.—Hewitt Rubber Corp. The summer issue of "Hewitt Magazine" contains two articles of interest to the rock products industry: "How to Select Conveyor Belting" and "Getting Top Efficiency from your Transmission Belts."

Coal Mills.—Stephens-Adamson Mfg. Co.—A new Mosley Mill bulletin contains dimensions, capacities and installation data on this new mill, in which dry materials pulverize themselves by attrition as a powerful current of air sweeps them around the grinding chamber.

Couplings.—Morse Chain Co. Bulletin 57 contains complete engineering data, installation and operating information, and recommended applications for the entire Morse flexible coupling line.

Crushers.—Allis-Chalmers Mfg. Co., has issued Bulletin B6006 entitled "Type R. Reduction Crusher for Finer Crushing" which contains information, specifications and illustrations about this new crusher.

Crushers.—Smith Engineering Works. —Bulletin No. 263 features the Telsmith Gyrasphere crushers. The detailed description and cut-away views of these crushers is supplemented by numerous views of typical installations.

Crushers and Pulverizers.—The Jeffrey Manufacturing Co. Catalog 710 describes the uses, operation, features, speeds, and capacities of Jeffrey swing hammer pulverizers and crushers.

Crushers and Screens.—New Holland Machine Co., has several new bulletins describing its equipment. No. 69 is on its cinder crushing equipment; No. 70, its pulverizers; No. 71, its hammer crushers; and No. 72, its vibrating screens.

Drifters. — Worthington Pump and Machinery Corp. Bulletin H-1200-B25, describes and illustrates the Worthington screw feed, air motor feed, and pneumatic feed heavy duty drifters.

Jar Mills.—The United States Stoneware Co. has issued bulletin No. 250 which describes and illustrates its line of jar mills, ball mills and mill jars.

Manganese Steel.—American Manganese Steel Division. A new 64 page catalog contains sections discussing the origin, physical properties and ability of manganese steel to resist impact and abrasion; information on the company's plant and research facilities and illustrations of the great variety of manganese steel castings manufactured.

Power Equipment. — Chicago Electric Co., has issued a new 8 page illustrated bulletin which describes the rebuilt and guaranteed electrical motors, generators, frequency changers, pumps and boilers, air compressors, transformers, and switchboards it has available.

Refractory Brick.—The Ironton Fire Brick Co. has issued a bulletin describing the qualities and uses of Peerless Ironton fire brick.

Recording and Controlling Instruments.—The Bristol Co., has published the following bulletins: No. 512 on its system of coördinated process control which outlines how to analyze a situation in which a uniform high-quality product is desired at lower production costs; No. 525 is about the Bristol humidity recorders and controllers; No. 528 is on its multiple-record pyrometer; No. 529 is about its strip-chart resistance thermometers; and bulletin 538 is on the new Bristol portable voltmeter.

Screens.—Robins Conveying Belt Co. A new bulletin No. 105 describes and illustrates in detail the Robins Style H and Style J Vibrex screens. The bulletin also contains interesting sections on proper suspension of screens and proper slope of screening surface.

Steels.—Joseph T. Ryerson & Son, Inc. The new Ryerson stock list and steel data book includes a detailed listing of the many new products and sizes recently added to the Ryerson stocks of certified steel products.

Temperature Detector.—Leeds & Northrup Co. Folder N33B (2) describes the Rayotube temperature detector and shows some of its applications on rotary and vertical kilns. Also included is information on the lightweight, portable Rayotube pyrometer.

Tires.—B. F. Goodrich Co., has just published its 1939 edition of the "Operators Handbook" which provides information on all types of tires other than those for passenger cars and data on the Goodrich tires offered for such purposes.

V-belt Drives. — Manhattan Rubber Mfg. Division of Raybestos-Manhattan, Inc. A new engineering data book covers standard drives and eliminates the necessity of working out calculations and sheave factors for designing new or special drives.

Wire Rope.—Macwhyte Co. "How Sheave Materials Affect Wire Rope Service" discusses the use of proper and improper sheaves.

News of the Industry

United States Rubber Co., New York, announces that Willard H. Cobb, for the past several years general factory manager, mechanical goods plants, has been appointed general manager of the mechanical goods and general products divisions. Herbert E. Smith, vice-president, will continue supervision of all the activities of the division.

W. W. Sly Mfg. Co., Cleveland, Ohio, reports that Frank W. Klatt has returned to the company as general manager, a position he formerly occupied from 1920 to 1927.

American Engineering Co., Philadelphia, announces that it has recently purchased the Diamond Machine Co., Providence, R. I., and will continue the manufacture of the Diamond face grinder in its Philadelphia plant.

American Manganese Steel Division of the American Brake Shoe & Foundry Co., Chicago Heights, Ill., has made the following additions to its main plant: a new administration building, an employees' welfare building, a large addition to the west foundry building, new pattern storage facilities, a machine shop addition, a shipping room addition, and a new heating plant.

Good Roads Machinery Corp., Kennett Square, Penn., has been granted exclusive rights for the manufacture and sale of the Speed Dumper, truck hoist and multiple bucket equipment for loading, hauling, and dumping material.

Patterson Foundry & Machine Co., East Liverpool, Ohio, has announced a program of plant improvements involving an expenditure of approximately $80,000 to be carried out at the East Liverpool plant.

Marion Steam Shovel Co., Marion, Ohio, has recently appointed J. F. Weis, formerly assistant electrical engineer, as special sales representative to supplement the work of Marion salesmen.

Independent Pneumatic Tool Co., Chicago, Ill., has opened a branch office at 1544 Broadway, Denver, Colo. C. A. Turnquist will be in charge.

Link-Belt Co., Chicago, announces that Frank S. O'Neil has been appointed general manager of the company's plants in Indianapolis, of which he had been assistant general manager for the last seven years. Mr. O'Neil joined the Link-Belt organization 33 years ago at its Chicago plant. His Indianapolis plant experience dates back to 1916.

Frank O'Neil

While at Indianapolis, he served as assistant superintendent in charge malleable iron chain assembly, superintendent of the Ewert plant and assistant general manager of both Ewert and Dodge plants.

Farrel-Birmingham Co., Inc., Ansonia, Conn., has appointed George Schaefer manager of the rolling mill machinery sales division to succeed Norman Shaw, who has been appointed manager of the company's Chicago office. Mr. Shaw will succeed Harry Temporal, who is being transferred to the Buffalo division.

New Incorporations

Grimes Mill Quarry and Rock Co., Lexington, Ky., has been incorporated by H. H. Givin, Louise Givin and Marjorie Spencer, with a capital of $500.

Lain Gravel Co., Cleburne, Tex., is the name of a new Texas corporation having a capital stock of $15,000. Incorporators are J. Lambert Lain, Lorena Lain, and J. E. Lain.

Burgundy Hills Quarries Corp., Boston, Mass., has been granted a charter. Capital is 2000 shares no par value and incorporators are Mary A. Comley, Guy H. Healey, and Randolph G. Webber.

Concrete Brick and Stone Co., Sioux City, Ia., has been incorporated with a capital stock of $25,000. F. K. Lytle is president; B. S. Peete, vice-president; and R. W. Pitner, secretary. The company plans to erect a new building and manufacture concrete block and brick.

Arkansas Slate Co., Inc., Glenwood, Ark., has been granted a charter. Authorized capital stock is 500 shares of $100 par value each and paid in capital is $500. Incorporators are C. P. Saviak, W. I. Meeks, Marie N. Saviak, Boyd Tackett and M. C. Saviak.

NATIONAL ASSOCIATION ACTIVITIES

Sand and Gravel

EXECUTIVE SECRETARY V. P. AHEARN in a recent bulletin brought before the membership his correspondence and negotiations with the Commissioner of Internal Revenue regarding the meaning of certain exemptions contained in the Social Security Act which apply to employment on navigable waters of the United States. Amendments are pending which have received the endorsement of the House Ways and Means Committee under which all employes in the marine end of the sand and gravel industry would become subject to the Social Security Act, and it is believed that they will be passed. All members of the industry using navigable waters should therefore prepare themselves to apply the Social Security Act to men on floating equipment, effective January 1, 1940.

Industrial Sand

IN A RECENT LETTER to the National Industrial Sand Association, Executive Secretary V. P. Ahearn reported on the hearings covering seasonal exemption. A further study is being made of the subject, and its initial effort will be to concentrate on seasonal exemption for producers of natural bonded foundry sand, crude silica sand, and industrial sand produced in exposed plants involving the use of water, wherever the climatic conditions surrounding such operation are such as to establish a prima facie case that they are seasonal in character under the statute and under the regulations prescribed by the Administrator.

Ready Mixed Concrete

ATTENTION OF THE INDUSTRY has been called to the passage by the Senate of amendments to the Walsh-Healey Public Contracts Act which provides that the law will apply to contracts or subcontracts with any agency of the Federal government in excess of or equal to $4000. The present act applies only to contracts whose value exceeds $10,000, and subcontracting is not included. It is not believed that the House will pass the amendments in their present form, including added penalties and a blacklist of violators. The National Ready Mixed Concrete Association bulletin, in commenting on the proposed legislation of the President for a program of self-liquidating loans totaling $3,860,000,000 points out that there is some doubt that the section which provides for $750,000,000 to be spent for express post roads, including self-liquidating toll roads, toll bridges, high-speed highways and city by-passes, will be looked upon with favor as the recent Bureau of Public Roads report on the feasibility of superhighways stated that this type of road could not be made to pay for itself through tolls or special levies. This report, however, did contain a thorough engineering study, and its recommendations would call for a large expenditure for by-pass roads and connecting highways. A complete analysis of this report appeared in the June issue of ROCK PRODUCTS.

New York Crushed Stone

THE NEW YORK STATE Crushed Stone Association held a meeting at Buffalo, N. Y., on June 21, with President H. E. Coleman presiding. The interpretation of various labor laws pertaining to dust control and silicosis were discussed at length by Stirling Tomkins, A. G. Seitz, and H. E. Coleman. The final draft of the proposed code relating to the control of dust in stone crushing and allied industries was presented by Secretary E. T. Nettleton. James Savage talked about the status of the petition now pending before the New York State Board of Standards and Appeals regarding exemption from the maximum limit of only four hours for repair work on Sundays. It was also announced at the meeting that the application of the New Haven Trap Rock Co. for membership had been received and accepted. John H. Feigle, assistant engineer, Bureau of Engineering, City of Buffalo, was the luncheon speaker. After luncheon the discussion concerned three different plans to combat diversion of highway funds. The plan suggested by Wilson Foss, Jr., was adopted.

Those in attendance included: Wilson P. Foss, Jr., Stirling Tomkins, F. W. Schmidt, H. E. Rainer, H. N. Barnes, Harvey N. Clark, John E. Redman, J. L. Heimlich, A. G. Seitz, George E. Schaefer, A. J. Hooker, Ralph S. Hunt, H. E. Coleman, E. T. Nettleton, Bill Anderson, Bryant Currier, A. E. Fielding, H. N. Snyder, E. J. Nunan, James Savage, M. J. Wurtenberger, E. K. Webster, John H. Feigle, W. O. Lenihan.

The next meeting of the association was announced for July 26, at Syracuse Yacht Club, Syracuse, N. Y.

Lime

SECRETARY BRUMBAUGH of the National Lime Association in a recent bulletin called the attention of members to a proposed change in the Bureau of Marine Inspection and Navigation regulations governing containers for water shipments of quicklime. The regulations would provide for the elimination of paper and cloth bag containers for quicklime shipped by water.

One provision of the Emergency Relief Appropriation Act of 1939 signed by the President states, "(b) The funds provided in this section shall be available for . . . the production of lime and marl for fertilizing soil for distribution to farmers under such conditions as may be determined by the sponsors of such projects under the provisions of State law . . ." H. A. Huschke, manager of the agricultural department of the Association, points out that while lime manufacturers have opposed this provision, believing that it would encourage the use of WPA labor and funds to produce "lime and marl," Wisconsin is the only state which now has a law under which this provision would operate.

Chicago will be host to the National Lime Association 1940 convention which has been tentatively scheduled by the Board of Directors to be held in the third or fourth week of May, at the Drake Hotel.

Concrete Vault Meeting

OHIO CONCRETE VAULT Manufacturers Association held a convention and exhibit at Dayton, Ohio, on June 14 simultaneously with the Ohio Funeral Directors' convention. L. K. Huber was elected president; A. M. Lendrum, vice-president; and E. C. Jefferies, secretary-treasurer. Directors are: G. H. Blackstone, R. P. Hilles, W. C. Fithian, and J. H. Stuart. President Huber paid tribute to the work performed by the late H. A. Ledyard, first vice-president, whose firm was represented by L. M. Holmes, a son-in-law, now president of the company. Tribute was also paid to J. H. Stuart, the first secretary, who with Mr. Ledyard was cofounder of the Ohio Concrete Burial Vault Association. Brief remarks were also made by past presidents R. P. Hilles and Calvin Bell, secretary-treasurer, E. C. Jefferies, and R. W. Mead, secretary and treasurer of the National Concrete Burial Association.

Largest Aggregate Order For Shasta Dam

THE U. S. BUREAU OF RECLAMATION recently announced that the low bid for aggregates to supply Shasta dam was submitted by Columbia Construction Co., Inc., Oakland, Calif., to furnish 7,600,000 tons of gravel and 2,800,000 tons of sand for $4,413,520. The material will be supplied from the Hatch tract. Redding Construction Co., Redding, Calif., submitted the second low bid of $4,541,600 to furnish sand and gravel from the Kutras tract.

Pacific Coast Aggregates, Inc., San Francisco, Calif., probably will participate in the contract for aggregates awarded to the Columbia Construction Co., to an amount said to be nearly $500,000. It is also understood that Pacific Coast Aggregates will become interested financially in the Permanente Cement Co. All three companies have similar financial control.

Mississippi Cement Plant Project Revived

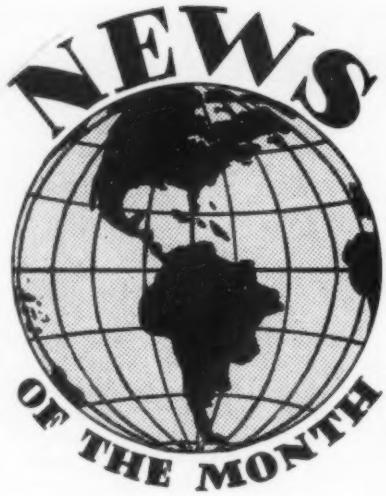
REPORTS FROM COLUMBUS, MISS., state that a cement plant to cost $1,500,000 with a capacity of 700,000 bbl. will be built two miles north of Macon, Miss. In 1938, the Cotton States Portland Cement Co., Jackson, Miss., a company in process of organization, proposed to build a cement plant near Macon, using the adjacent chalk deposits for raw material.

Add Ageing Tank to Lime Putty Unit

THE LOUISVILLE LIME MORTAR CO., Louisville, Ky., has placed an order with the Chicago Bridge & Iron Co. for an additional ageing tank for their Brooks-Taylor lime putty plant. The additional tank will almost double the capacity as deliveries can be made from two of the tanks while the putty in the third is ageing. It is identical to the two installed with the original plant, and is 10 ft. in diameter by 28 ft. high with a capacity of 2500 cu. ft. of putty.

Sardis Dam Results In Big Order

SARDIS DAM, near Sardis, Miss., is taking large quantities of aggregates and cement. The federal reservoir project requires 65,000 cu. yd. gravel, 60,000 cu. yd. concrete, and 17,000 cu. yd. stone. Work was started last January, but pouring of concrete did not commence until the first week in July.



New California Mill Buys Land

PERMANENTE CORP., Los Altos, Calif., building the new cement plant over which there has been considerable local controversy, recently closed a deal for the purchase of 1000 acres of land surrounding the location of the mill. The corporation had leased the land a year ago for a three-year period at $12,000 rent per year, with an option to purchase. The deed was signed by F. A. Bailey, vice-president, and G. F. Dauler, secretary of the holding company.

Lehigh's Union Bridge Plant Starts Operation

LEHIGH PORTLAND CEMENT CO., Union Bridge, Md., plant resumed operations after an extensive modernization program had been completed. Five new buildings have been constructed at the plant and work is still under way on a sixth. The new construction includes cement storage silos and storage bins for raw limestone and shale, a modern power plant, and a new mill building.

Rebuilding Plants Destroyed by Fire

RACEX LIME & FUEL CORP., Catskill, N. Y., will start rebuilding operations on August 1, to replace the structure and equipment destroyed by fire this spring.

GRANITE ROCK CO. plans to rebuild the quarry structures and asphalt hot mix plant near Aroma, Calif., which was recently destroyed by fire, causing damage estimated at $8000, entirely covered by insurance. The hot mix plant was entirely destroyed, portions of two long conveyors and housing were burned, and part of the rock recleaning plant was damaged. Included in the loss is the elaborate electrical control system used at the Logan quarries.

WILLIAM SCHNEIDER CRUSHED STONE CO., Springfield, Mo., had a fire which caused damage estimated at $10,000. Most of the crushing machinery was badly damaged.

HOSTETTLER CRUSHED STONE CO., Bedford, Ind., suffered a loss from a fire which destroyed the power plant, air compressor, and electric motors, causing damage amounting to between $4,000 and $5,000.

Alpha to Build More Cement Silos

ALPHA PORTLAND CEMENT CO. has plans to construct 18 new silos at the Easton, Penn., plant, according to N. D. Colburn, general superintendent. Ten of the silos will be designed for storing the finished product and will hold about 65,000 bbl. The other eight will be blending silos constructed for raw material, and will hold about 5000 tons. With nine silos recently completed, the plant will have a total of 27.

Phosphate Activities In Tennessee

REPORTS from the Tennessee phosphate field show that shipments in all lines dropped off during June and up to the middle of July were below 1938 figures. However, orders are again beginning to come in rapidly for ground rock from farmers, from manufacturers of special preparations, and shipments are resuming to super - phosphate manufacturers, though not yet the heavy volume that will come in August. Evidences of advancing prices are noticeable in all lines.

Silica Company Publishes Booklet

STANDARD SILICA CORP., Chicago, Ill., has published a beautiful 27-page illustrated booklet about its products —Microsil ground silica and Blackhawk silica sand. It describes in a manner understandable to the uninitiated the processes involved in producing these products, the properties and uses of them, and the care taken by the company in distributing them. Full page illustrations add to the attractiveness and clarity of the booklet, and an interesting two-page chart in the form of a tree shows the types and uses of sands and silica products.

Gravel Plant for Federal Canal Project

THE DENNIS CONSTRUCTION Co. is building a sand and gravel plant to supply material for the western part of the second section of Coachella lateral, All-American Canal, near Salton, Calif. An artesian well has been dug to supply 400 g.p.m. of water, and material handling equipment and screening plant are being erected.

Crushed Stone Safety Contest

PORT INLAND LIMESTONE QUARRY in Mackinac County, Mich., operated by Inland Lime and Stone Co., Chicago, Ill., has been announced by the Bureau of Mines as the 1938 winner in the safety contest conducted under the auspices of the National Crushed Stone Association. This plant was operated for 299,751 man-hours without a disabling injury.

A certificate of honorable mention was awarded to 21 plants, in addition to the trophy winner, that operated during the year with an accident-free record. Those receiving the certificates of honorable mention included:

Columbia Quarry Co., Krause No. 1, Columbia, Ill.
Raleigh Granite Co., Raleigh, N. C., division of Southern Aggregates Corp., four granite quarries, Woodleaf, Rolesville, Wake Forest and Reidsville, N. C.
Ohio Marble Co., Piqua, Ohio.
New Haven Trap Rock Co., four trap rock quarries, North Branford, Middlefield, West Cheshire and Rocky Hill, Conn.
General Crushed Stone Co., two limestone quarries, Leroy and Jordanville, N. Y. ;one sandstone quarry, White Haven, Penn.; and a trap rock quarry at Winchester, Mass.
Marquette Cement Mfg. Co., Cape Girardeau, Mo.
Stewart Sand and Material Co., limestone mine, Independence, Mo.
Union Limestone Co., Hillsville, Penn.
Wickwire Spencer Steel Co., limestone quarry, Gasport, N. Y.
North American Cement Corp., two limestone quarries, Catskill, N. Y., and Howes Cave, N. Y.
Southwest Stone Co., trap rock quarry, Knippa, Texas.

First Complete Report On Slag Production

THE NATIONAL SLAG ASSOCIATION, Washington, D. C., has recently issued a very complete report on the production and uses of slag. Divided into four principal producing areas, the report gives the various uses of slag, the number of tons, total value, and average value per ton. The report also divides the production into air cooled and granulated.

In 1938, there were 34 companies operating a total of 70 plants engaged in preparing blast furnace slag for the market. A total of 7,978,066 short tons of air-cooled and granulated slag valued at $6,246,615 was processed in the United States during 1938 for commercial uses such as road metal, building construction, railroad ballast, roofing aggregate, fill material, mineral wool, and agricultural products.

Of the total tonnage produced, 7,321,259 tons were air-cooled (screened and unscreened) slag, valued at $6,167,892 for principal uses as aggregate for concrete construction, road building, and railroad ballast. The average price range, depending on the processing and the use, ranged from 39c to $1.40 per ton, excluding the peak price of $3.50 per ton the use of which was not revealed. Granulated slag represented 656,807 tons valued at $43,731, with a peak value of 79c per ton for agricultural purposes, for which special processing was necessary, to a low of 8c per ton for fill.

Place Large Coulee Dam Cement Order

PACIFIC NORTHWEST cement mills are assured continued full-time operation of their plants with the placing of orders to supply cement for the Grand Coulee dam. The total awards were for 3,500,000 bbl. of low heat cement, divided among seven firms. Superior Portland Cement Co., Seattle, Wash., received the largest order for 1,452,000 bbl. at $1.50 per bbl. Other awards were as follows: Olympic Portland Cement Co., Bellingham, Wash., 697,000 bbl. at $1.44½ per bbl.; Lehigh Portland Cement Co., Metaline Falls, Wash., 450,000 bbl. at $1.55; Northwestern Portland Cement Co., Grotto, Wash., plant, 145,000 bbl. at $1.44½; Spokane Portland Cement Co., Erwin, Wash., plant, 250,000 bbl. at $1.70; Santa Cruz Portland Cement Co., Portland, Ore., plant, 267,000 bbl. at $1.50; and Calaveras Cement Co., Kentucky House, Calif., plant, 89,000 bbl. at $1.28. In addition to the low heat cement orders, awards for other cement included: 27,000 bbl. at $1.45 to Lehigh Portland Cement Co.; and 135,000 bbl. at $1.45½ to Northwestern Portland Cement Co., Seattle, Wash.

Universal Opens Green Bay Cement Packing Plant

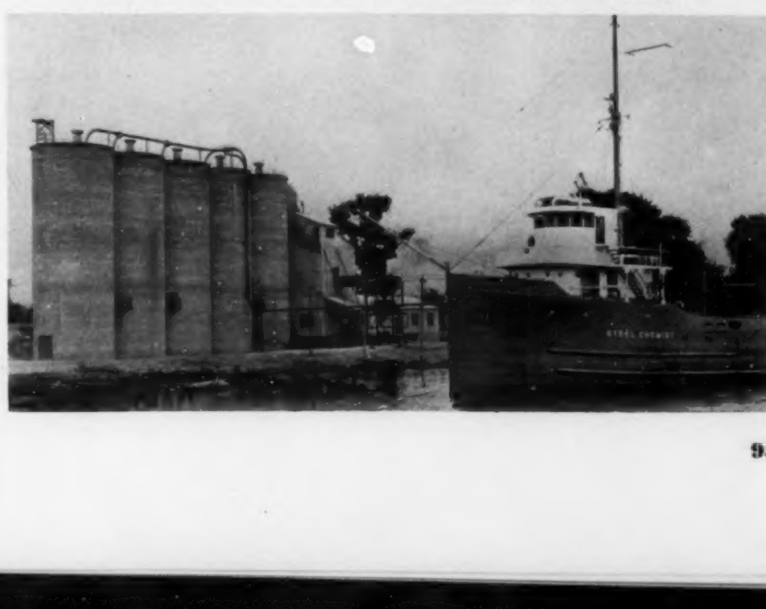
A LARGE DELEGATION of business and civic leaders of northeastern Wisconsin attended the informal open house program at the new Green Bay, Wis., packing plant of Universal Atlas Cement Co., on July 7. Operations at the new unit, one of the most modern and efficient in the country, began July 5.

A. C. Cronkrite, vice-president of Universal Atlas Cement Co., filling the first sack of cement at the new Green Bay, Wis., plant

During the inspection of the plant guests viewed the various operations by which the bulk cement, which is received at the plant's own dock in cargo lots from lake steamers, is packaged for delivery to the market.

Vice-president A. C. Cronkrite of the Universal Atlas Cement Co., filled the first sack of cement at the new packing plant.

First cargo of cement delivered to the new Green Bay, Wis., packing plant of Universal Atlas Cement Co., by the motorship "Steel Chemist"



FINANCIAL NOTES

RECENT DIVIDENDS ANNOUNCED

Florida Portland Cem., pfd.	$2.00	Aug. 15
Ideal Cem. Co.	.35	June 30
Louisville Cem. Co.	.75	Aug. 1
Monolith Portland Cem., pfd.	.25	Aug. 15
National Gypsum Co., pfd.	.12½	Sept. 1
Riverside Cem. Co., pfd.	1.50	Aug. 1
Southern Phosphate Corp.	.15	June 30

THE SOUTHERN OHIO QUARRIES CO., Columbus, Ohio, has filed articles amending its corporate charter to provide for an increase in preferred stock amounting to $50,000. With the increase in preferred, representing 500 shares at $100 per share, the company has an authorized capital of 100 shares of class A, no par value common, 150 shares of class B, no par value common, and 1250 shares of preferred, or $125,000. The articles were signed by E. H. Davis, president, and Harold C. Slater, secretary.

SCHUMACHER WALL BOARD CORP., Los Angeles, Calif., has announced that a new plant will be constructed on a 12-acre site. With machinery and structure, a capital expenditure of $1,500,000 will be represented.

LEHIGH PORTLAND CEMENT CO., Allentown, Penn., for the 12 months ended June 30, 1939, shows a net profit of $1,606,937, after federal income taxes, depreciation, depletion, obsolescence, etc., equal after deducting $227,004 dividends paid on 4 percent convertible preferred stock, to $1.83 a share on 754,434 shares (par $25) of common stock. This compares with $521,505 or 39c a share on common for the 12 months ended June 30, 1938.

THE BLUFF CITY LIME CO., subsidiary of the Mississippi Lime and Cement Co., Alton, Ill., was reported to have purchased the Western Lime Works, Ste. Genevieve, Mo.

UNITED STATES GYPSUM CO. reports net income for the 12 months ended was $5,662,153, compared with $4,200,976 for the same period a year ago. Earnings for the first six months were $3,117,857, compared with $2,181,219 for a similar period in 1938.

KENTUCKY STONE CO., INC., Louisville, Ky., showed a net income of $24,357 for the year ended April 30, 1939. For the same period a year ago the net income was $1845. Net sales in the first four months of 1939 were $543,084.

NEW YORK TRAP ROCK CORP., New York, N. Y., has announced through Smith, Barney & Co., as agents, that on June 29, $493,000 of the company's 1st 6s, due 1946, tendered for sale pursuant to a recent sinking fund call had been accepted.

SCHUMACHER WALL BOARD CORP., Los Angeles, Calif., reports a net income for the year ended April 30, 1939, of $136,951. This compares with $33,499 for the same period a year ago.

ARUNDEL CORP., Baltimore, Md., had a net profit in May of $144,058, and for the five months ended May 31, the net income was $470,892. For the first five months in 1938, the net income was $428,862.

INDUSTRIAL SILICA CORP., Youngstown, Ohio, reported on June 16 that its $500,000 1st 6s, due June 1, 1939, had been refunded by new five-year first mortgage 5 percent notes, with minimum annual payments of $50,000 and additional payments depending on earnings.

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ALPHA PORTLAND CEMENT CO., Easton, Penn., reports for the 12 months ended June 30, 1939, net profit of $698,195, equal to $1.09 a share on 639,500 no par shares of capital stock, against $9977, or one cent a share in the 12 months ended June 30, 1938.

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MATHIESON ALKALI WORKS, INC., New York, N. Y., has announced the lease of its North Holston, Va., gypsum plant and mines to the National Gypsum Co., Buffalo, N. Y., for a reported consideration of $20,000 a year. According to the announcement, the Mathieson company is getting out of the gypsum business. Simultaneous with this announcement, the Mathieson Alkali Works, Inc., announced that a new plant would be erected at Lake Charles, La., to produce synthetic salt cake (sodium sulphate) by a new process to supply the paper industry.

Reorganization Plan for Superior Cement Co.

A TENTATIVE REORGANIZATION PLAN for the Superior Cement Co., Portsmouth, Ohio, has been submitted by Judge William J. Jones, who was recently named permanent trustee for the company. The plan provides for redemption of $241,500 worth of 6 percent first mortgage bonds secured by mortgage on the company's real estate and personal property with a new issue of 5 percent bonds in the same amount secured by the same property. The new bonds are to be issued September 1, 1939, and are to mature September 1, 1949. A sinking fund is to be established by the annual payment of a minimum of $24,100 from September 1, 1940, which amount is to be obtained by a payment of 7½c per bbl. on all cement sold by the company. Any deficiency is to be made up by the company. The debtor will also issue $280,000 in 5 percent income debentures, which are to be distributed to the New York Coal Sales Co. in exchange for a $233,000 mortgage and to the Southern Ohio Electric Co. in exchange for a $47,000 debt. In addition, the coal sales company is to receive 4010 shares of new no par value stock of the reorganized company. Unsecured creditors and wage claimants are to be paid in full.

CELOTEX CORP., Chicago, Ill., showed a profit of $190,000 for June after all charges with the exception of federal income taxes, for which the company claims statutory deductions. This compares with a net profit of $62,000 for June, 1938.

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SUPERIOR CEMENT CO., Portsmouth, Ohio, now in receivership, has issued through the trustee a report on operations from February 1 to June 30. It shows total net earnings to May 31 of $17,781. A survey of the plant by engineers employed by the trustee resulted in economies which will save the company $30,000 a year. The trustee informed the court that additional savings can be effected if $19,000 is expended for certain equipment. This expenditure, the trustee reported, can be financed from the company's depreciation reserve of $19,400.

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OLD COLONY CRUSHED STONE CO., and the Old Colony Asphalt Concrete Co., both of Quincy, Mass., have been consolidated and will be operated as the Old Colony Crushed Stone Co. There will be no change in the personnel.

Calcining, Hydrating Lime

(Continued from page 73)

injected. At this low temperature they were quite effective in cooling the fire, but they robbed the hot zone of an immense amount of heat with resulting inferior kiln performance. The amount used was so small that it did not increase the kiln gas velocity much, if any. Heat transfer varies as the 1.7 power of velocity. If recirculation is practiced, it must be done so that the harmful effect caused by gas recirculation is counteracted by higher heat transfer due to higher velocity which is possible only when the recirculation is of a large volume of hot, rather than a small volume of cooled gases. It can be done if there is sufficient reason.

Experimentally, Haslam and Herman revealed that Ohio lime will have a plasticity of 500 calcined for three hours at 2000 deg. F. and only 100 if calcined for the same time at 2250 deg. F. They showed the great effect on plasticity that small ranges in temperature and in time of calcination apparently have and also showed that not only too high but also too low temperatures are harmful. However, no proof is necessary that even the purest of high calcium under excessive heat becomes dense and heavy.

By lower temperatures, we may not be able to avoid, entirely or in some cases at all, formation of silicates, aluminates or ferrates of calcium, but the matrix will not spread by taking into itself more and more lime and isolate from access to water such other lime that it may not be able to gather directly. We know that the presence of silica negatives more lime than any known chemical combination of the two, and the higher the temperatures or time of calcination the greater this gets to be. Burn it at high enough temperatures and long enough and it either approaches or gets to be a conglomerate clinker.

There are dolomite plants, in which temperature control is most important and lowest temperature the most desirable, that approach the problem incorrectly. In Fig. 3-A is shown one of such kiln crudities. It is difficult to operate right and the lime obtained is neither this nor that, much of it is overburned and much of it is underburned. The lines of equal temperature superimposed are not imaginary, but actually determined. It will be noted that the temperatures are not only far from those recommended but also quite uneven over the entire hot zone cross-section. Fig. 3-B shows a similar kiln improved.

As a contrast, Fig. 4 is presented which the writer considers as the very minimum of what a simple hand-fired kiln should be. At first sight, it may not be so different from the ordinary kiln but actually it is radically changed. The main differences are:

1) The cooler has a single cone but a double draw and as the cooler is divided more lime can be taken from one side than the other if that proves desirable, which is frequently the case.

2) The center of the shaft has a saddle on which the weak center rests and so helps the lime to hang without heating it to incipient fusion. This permits more frequent drawing.

3) The kiln is not trimmed through the furnaces, but rather through strategically located poke holes, through which all sections of the hot zone can be reached; including sections that in ordinary kilns are the hottest, but inaccessible, that is the region right over the furnace arches.

4) The air for combustion enters through the cooler and the furnaces are modified semi-gas producers equipped with shaking grates and arranged for maintaining a deep firebed.

5) There is a CO_2 recirculating system of the Eldred type that, however, could be substituted by one of the improved type presented next month.

6) The storage zone sections are streamlined for more uniform down-travel of rock.

7) The top of the kiln is closed in and equipped with a substantial stack.

Such a kiln is far more efficient and also makes better lime, the latter because the lime from the hottest sections can be speeded into the cooler. It is also more efficient because there is a better control over the combustion process and over distribution of heat.

(to be continued)

Safety Contest Winners in Sand and Gravel Industry

WINNERS of the 1938 sand and gravel producers' safety contest have been announced by the Bureau of Mines. This contest conducted by the Bureau in coöperation with the National Sand and Gravel Association every year presents trophies and certificates of merit provided by ROCK PRODUCTS.

In the group that worked 100,000 or more man-hours, the Captain plant of McCrady Rogers Co., in Beaver County, Pennsylvania, a river deposit, was the winner of the trophy. The winner of the trophy for operation without a lost-time accident in the group working less than 100,000 man-hours was the Rancho plant, a dry-pit deposit at Roscoe, Calif., operated by Graham Bros., Inc., Los Angeles, Calif.

Two plants in the large group and 33 plants in the small group were successful in winning the certificates of merit. Of the 70 plants enrolled in the contest, 37 plants worked the full year without an accident. The following received certificates of merit for working a full year without a lost-time accident:

Warner Co., Philadelphia, Penn., Van Sciver Lake plant, Tullitown, Penn.

Marquette Cement Mfg. Co., Chicago, Ill., Wolf River wet-pit plant, Memphis, Tenn.

Fort Worth Sand and Gravel Co., Fort Worth, Texas, Quigley wet pit plant, Hurst, Texas.

Consolidated Rock Products Co., Los Angeles, Calif., four dry pit plants, Irwindale, Azusa, Orange, and Monrovia, Calif.

Dixie Sand and Gravel Co., river plant, Chattanooga, Tenn.

Industrial Silica Corp., Youngstown, Ohio, three dry bank deposits, Garrettsville, and Dundee, Ohio, and Geauga Lake, Penn.

Lincoln Sand and Gravel Co., wet pit, Lincoln, Ill.

J. M. Dugan, river plant, Plainville, Ohio.

Stewart Sand and Material Co., two river plants, Kansas City, Mo., and Turner, Kans.

American Aggregates Corp., Greenville, Ohio, two dry bank deposits, Kalamazoo, Mich., and Richmond, Ind., and wet pit, Logansport, Ind.

Lyman Richey Sand and Gravel Corp., Omaha, Neb., eight lake plants, Columbus, Valley, (2) Plattsmouth, (2) Fremont, Grand Island, and Central City, Neb.

Eastern Rock Products, Inc., Utica, N. Y., wet pit, Frankfort, N. Y., dry bank, Boonville, N. Y.

General Concrete Products Corp., river plant, Warren, Penn.

Blue River Sand and Gravel Co., wet pit, Irving, Kans.

Schmidt Bros. Sand Supply Co., wet pit, Garfield Heights, Ohio.

Graham Bros., Inc., Los Angeles, dry pit, El Monte, Calif.

Pioneer Sand and Gravel Co., river plant, Choteau, Okla.

Ray Industries, Inc., dry bank, Fremont, Neb.

Gypsum Industry Shows Improved Conditions

DURING the first quarter of 1939, conditions in the gypsum industry were considerably better, chiefly as a result of the relatively heavy building construction contracts awarded during the latter part of 1938. From January to March, inclusive, the Bureau of Mines reports that 541,183 tons of crude gypsum were produced, compared with 453,420 tons in the same period in 1938; calcined gypsum production totaled 533,440 tons as against 447,049 last year. Wall board production totaled 95,981,342 sq. ft. in the first quarter of 1939 as compared with 91,456,565 sq. ft. in a similar period of 1938. Gypsum lath amounted to 207,417,935 sq. ft. in the first three months this year as compared with 140,616,411 sq. ft. in 1938.

New Enterprise

CEMENT PRODUCTS Co., Trinidad, Colo., started operations recently, producing concrete blocks, brick and ready-mixed concrete. Equipment also has been added to make concrete pipe, ash pits, and other specialties. The new products are steam cured.

To Make Cement From Carrara Marble

HARRY E. MICK, at one time assistant operating manager of the Coplay Cement Manufacturing Co., Coplay, Penn., and now president and superintendent of the Electro-Thermo Corp., Beatty, Nev., plans to make a special white cement from a marble deposit at Carrara, Nev. There is also a white clay deposit near the marble which has been acquired for use in the production of the white cement. There are 600 acres in the marble holdings and 400 acres of clay. Machinery is now being installed.

Perfect Safety Records

UNIVERSAL ATLAS CEMENT Co. plants at Buffington, Ind., Duluth, Minn., and Waco, Texas, had no lost-time accidents in 1938, qualifying them to receive the Portland Cement Association's safety trophy. The Buffington and Waco mills have now won the trophy two different years. The Duluth plant has had the honor for seven years, and each of the company's six other plants won the award one or more years.

Natural Cement Plants Are Busy

NATURAL CEMENT mills in the Rosendale, N. Y., district have been very active recently. Two cement plants, Century Cement Co., and A. J. Snyder Lime & Cement Co., are operating in this district. The Century company anticipates that its 1939 production will total over 400,000 bbls. Shipments have been made as far away as Salt Lake City, Utah.

Open Three New Quarries

TOBIN QUARRIES, INC., Kansas City, Mo., has placed two new quarries in operation near Nehawka, Nebr. The Pickens Quarry Co., which has operated the past few years along the Missouri river between Union and Plattsmouth, has opened up a new quarry on the John Hansen farm. Highway and other projects point to a heavy production of stone this summer.

Change Publishing Methods A.S.T.M. Standards

THE AMERICAN SOCIETY FOR TESTING MATERIALS, Philadelphia, Penn., has announced that effective November, 1939, the Book of Standards, issued triennially, and the Book of Tentative Standards, issued annually, will be combined. The new method will be to issue the standards and tentative standards collectively in one triennial publication, divided into three parts: Part I, Metals; Part II, Non-Metallic Materials—Construction; and Part III, Non-Metallic Materials—General. Publication of new and revised tentative standards in the annual Proceedings, Part I, will be discontinued; the Proceedings including both committee reports and papers will be bound in one volume. The publication of the annual Book of Tentative Standards will be discontinued entirely. Further details regarding these publications and the new prices may be obtained by addressing the Society.

Nebraska Starts Safety Campaign for Sand Pits

NEBRASKA department of labor has announced through V. B. Kinney, state labor commissioner, that a campaign will be undertaken this year to eliminate dangerous hazards in the operation of sand and gravel pits. It is being recommended that each pit, even though it may be temporary, should be equipped with a small row roat, a life ring with 50 ft. of ½-in. rope attached, and other life-saving apparatus. Another recommendation is that all floating equipment should have a catwalk with a hand-line, and that all belts, pulleys, and other moving machinery on floating as well as shore equipment be properly guarded to prevent serious injury. A guard rail around each boat is a further safety measure which is being urged as essential.

Warn Children About Dangers of Blasting Caps

INSTITUTE OF MAKERS OF EXPLOSIVES, New York, N. Y., report that during the years from 1934 to 1937 there was a steady reduction in the number of accidents to children playing with blasting caps. Unfortunately, there was a slight increase in 1938, and the institute has again broadcast warnings to the country to do everything possible to eliminate this source of accidents. These accidents start in the spring of the year and increase until a peak is reached in July and August.

Operators of quarries and other users of blasting caps in the rock products industries should work with school and safety organizations in this movement of the institute to eliminate this type of accident.

These accidents often result in children being blinded or losing fingers or hands, and thus going through life in a crippled condition. In some cases children are killed. Most of these accidents occur in country districts where children find the caps in the neighborhood of blasting operations, where, in many cases, they have been left by careless workmen. Playing with these caps; such as picking them with nails, hitting them with hammers, or throwing them into bonfires, usually results in an accident.

Kansas Quarry Busy Making Brick

THE QUARTZITE STONE Co., Lincoln, Kans., has been working its concrete brick plant at full capacity filling a contract for 80,000 bricks and other work. Brick will be made in blue, white and natural cement color. In addition to its brick plant, the quarry also has been active, according to E. W. Forney, plant superintendent. One large order for crushed stone is for 60 carloads to be used in the Russell, Kans., sewage disposal system.

First U. S. Deposit of Langbeinite

UNION POTASH AND CHEMICAL Co., Carlsbad, N. M., has announced the discovery of a deposit of langbeinite, the only one known in the western hemisphere. Its discovery will free the United States from a German monopoly. From langbeinite comes potassium sulphate, of which this country has been importing about 80,000 tons annually from Germany.

To Make Agstone

INDEPENDENT GRAVEL Co., Joplin, Mo., has started operations at its new plant on the Rogers-Pea Ridge road near Rogers, Ark. It is planned to produce gravel, crushed stone, and agricultural limestone. About $10,000 has been invested in machinery, according to a local report. A large limestone deposit has been opened up, and it is planned to produce crushed stone for highways and also agstone.

Discover Immense Deposit of Glacial Sand

MACHINERY is being installed to remove a tremendous deposit of sand and gravel in old Paint Creek glacial stream bed, a half mile north of the bridge near Rocky Ford, Ohio. According to local reports, the old channel of the pre-glacial stream is filled with sand and gravel dumped there by the glacier. Material in the deposit is said to be of an exceptionally good quality.

Adopt Truck Haulage In Gravel Plant

WESTERN SAND AND GRAVEL Co., Spring Valley, Ill., is now using truck haulage in its large sand and gravel pit to replace the locomotive and cars formerly used. Present demand is about equally divided between road gravel and washed sand and gravel. The plant is a Kern radial storage system, and the total capacity is 500 tons per hr.

PRICES BID Contracts Let

SAN FRANCISCO, CALIF.: Santa Cruz Portland Cement Co., submitted the lowest of three bids for an order which will amount to either 20,000 bbl. or 5000 bbl. of portland cement, for making repairs to South Jetty on Humboldt Bay. The company bid $2.33 a barrel, f.o.b. Humboldt Bay. Other bidders were Pacific Portland Cement Co., at $2.3455 per bbl., and Calaveras Cement Co. at $2.57 per bbl.

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ELY, MINN.: Veranth Co., was awarded a contract for 500 cu. yd. of gravel at $2.50 per cu. yd. and the Lampert Lumber Co. was awarded a contract on cement at $2.80 per barrel, the material to be used for sidewalk construction projects.

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PONTIAC, ILL.: Contract was awarded to Churchill Gravel Co. for 3787.5 cu. yd. of gravel to be spread on the Sanatorium-Weston road, at 93c per cu. yd. The only other bidder was Francis Nevill of Dwight with a bid of $1.20 per cu. yd.

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LONG BEACH, CALIF.: Graham Brothers was low bidder for 18,000 tons of crushed rock to surface an area where lumber may be stored on outer harbor land with a bid of 59c per ton. Other bids were Martin & Schmidt, 82c per ton; Owl Trucking Co., 74c; Moe Brothers, 107c; Ansco Construction Co., 67c. The Arrow Rock Co. was low among the bidders on 1200 tons of crushed rock, the other bidders being Azusa Rock Co., 99c per ton; Owl Trucking Co., 103c; Ansco Construction Co., 115c; and Graham Brothers, 97c.

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MT. GILEAD, OHIO: The county commissioners have authorized the purchase of 2000 cu. yd. of gravel at 45c per cu. yd.

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AUDUBON, IA.: The city council contracted with the Emery Construction Co. and J. R. Paul, Coon Rapids, for approximately 4000 cu. yd. of gravel at $1.25 per cu. yd. to be spread on streets.

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HARRISBURG, PENN.: The Lake Asphalt and Petroleum Co., at $25.10 per ton, less two percent for natural asphalt was low bidder on 750 tons.

Suit Filed Against New Cement Plant

A SUIT TO ENJOIN the Permanente Co., from building a $4,000,000 cement plant at Los Altos, Calif., was recently filed in Superior Court in behalf of 400 property owners. The suit charged the plant would damage property values by noise and fumes.

Cement Admixture Costs Less

DEWEY AND ALMY CHEMICAL CO., Cambridge, Mass., has announced another reduction in the price of TDA. According to the manufacturer, this is the fourth in four years and it has been made possible by manufacturing economies resulting from increased production and technological improvements.

Vermiculite Insulation

VERMICULITE SALES CO., may build a plant near Douglas, Wyo., to make a vermiculite insulation, according to C. O. Battles, manager. Vermiculite is now being mined extensively in Converse county from mines located in the Mormon flats, 13 miles south of Glenrock.

Blast Kills Son of Superintendent

WADE K. CONFER, son of the superintendent of Snake Butte quarry, operated by the federal government near Harlem, Mont., was killed by a falling piece of rock when a dynamite blast charge mysteriously went amiss. Instead of dropping a rock wall flatly, as expected, the explosive hurled boulders weighing up to 30 tons. Eighteen persons were injured, and considerable damage was done to railroad flat cars, camp buildings, etc. The youth who was killed had tried to photograph the blast.

Canada Reduces Cement Duty

THE DOMINION OF CANADA has cut the duty on United States imports of White Portland cement clinker from 20 percent ad valorem to 4c per 100 lb. It is said that this reduction has been made for the benefit of the Canadian manufacturer of white portland cement who has to import this type of clinker.

Cement Shipments Are Increasing

LATEST FIGURES issued by the Bureau of Mines show that in May, 1939 the portland cement industry produced 11,126,000 bbl., shipped 12,688,000 bbl. from mills, and had in stock at the end of the month, 22,275,000 bbl. Production and shipments of portland cement in May, 1939, showed increases of 7.4 and 30.1 percent, respectively, as compared with May, 1938. Portland cement stocks at mills were 2.6 percent lower than a year ago.

The statistics here given have been compiled from reports for May, received by the Bureau of Mines from all manufacturing plants except one for which estimates have been included in lieu of actual returns.

In the following statement of relation of production to capacity, the total output of finished cement is compared with the estimated capacity of 161 plants at the close of May, 1938 and 1939.

RATIO (PERCENT) OF PRODUCTION TO CAPACITY

	May 1938	May 1939	Apr. 1939	Mar. 1939	Feb. 1939
The Month	47.4	50.9	45.7	37.4	27.9
12 Months	41.3	43.8	43.5	42.8	41.9

Concrete Pavement Yardage

AWARDS of concrete pavement for June, 1939, have been announced by the Portland Cement Association as follows:

Type of construction	Sq. yds. awarded during June	Total sq. yds. during first six months
Roads	4,232,352	12,123,199
Streets & Alleys	2,623,029	9,154,429
Airports	86,227	281,790
Totals	6,941,608	21,559,418

Road Material Rates Cut

WATER AND TRUCK COMPETITION with railroads in the hauling of road construction materials has constrained the I.C.C. to authorize further reductions on such materials. The Commission on further hearing in the cases involved found that there was actual and compelling truck competition to Sedley and Valparaiso, Ind., from a quarry at Thornton, Ill., from a slag plant at South Chicago, Ill., and from docks at South Chicago, Ill., and East Chicago, Ind., but it said that a proposed rate of 50c a net ton from Lake Ciecott, Kenneth, Logansport, Winona Lake, and Wolcotville, Ind., to Valparaiso would be unreasonably low and unduly prejudicial and lower than necessary to meet the competition. It found, however, that a single line rate of 61c from the origins mentioned to Valparaiso would not be unreasonably low or unduly prejudicial, and no lower than was necessary to meet that competition. A further finding was that a joint line rate of 66c on sand, gravel and crushed stone to Sedley and Valparaiso, from Joliet, Plainfield, McCook, Lehigh and Bellewood, Ill., would not be unreasonably low or unduly prejudicial nor lower than was necessary to meet the competition.

Sand Lime Brick Production and Shipment

TEN active sand-lime brick plants reporting for June and seven for May, statistics for which were published in July.

AVERAGE PRICE FOR JUNE

	Plant Price	Delivered Price
Detroit, Mich.	....	$16.00
Milwaukee, Wis.	$10.00	12.50
Mishawaka, Ind.	11.00	....
Saginaw, Mich.	10.90	....
St. Louis Park, Minn.	8.00	9.50
Seattle, Wash.	14.50	16.50
Syracuse, N. Y.	14.00	16.00 C/L 18.00 L/C

STATISTICS FOR MAY AND JUNE

	May†	June‡
Production	1,936,525	2,957,610
Shipments (rail)	257,000	183,000
Shipments (truck)	2,148,080	3,420,440
Stock on hand	436,479	834,704
Unfilled orders	1,860,000	2,315,000

† Seven plants reporting: incomplete, one not reporting production, three not reporting stock on hand, and four not reporting unfilled orders.

‡ Ten plants reporting: incomplete, one not reporting production, three not reporting stock on hand, and three not reporting unfilled orders.

Complete Steel Sand and Gravel Plant

NORTHWEST GRAVEL CO., Lake View, Iowa, recently completed the installation of a modern steel plant at the gravel pit on the Guthrie farm west of Milford, Iowa. Eighteen men are employed at the pit under the direction of Cliff Ward. The company is furnishing gravel for the new highway from Milford to the Clay county line.

New California Plant

BLUE DIAMOND CORP., LTD., Los Angeles, Calif., has received approval of the city council to produce sand and gravel and crushed stone in the San Fernando Valley. The application for permission to build the plant involves a 38-acre tract near Strathern street and Tujunga avenue.

SMOOT SAND AND GRAVEL CO., Washington, D. C., awarded $68,330 for 32.68 acres lying near Hunter's Point. The land will be used for the new Washington National Airport at Gravelly Point.

Preheater for Rotary Lime Kiln Becomes Cooler for Cement

APPLIED to the head or feed end of a rotary lime kiln, the apparatus is a preheater, but when installed at the discharge end of a cement kiln, similarly designed equipment becomes a cooler. This somewhat unusual invention was recently developed by F. L. Smidth & Co., New York, N. Y.

Used as a preheater for a lime kiln, Fig. 1, it comprises an inclined grate enclosed in a steel housing, the grate being sloped at an angle corresponding to the angle of repose of the material. Hot exhaust gases from the kiln are drawn into the upper section of the preheater, through the heavy layer of raw limestone, and then pass at a considerably lower temperature from the lower section through a fan to the stack. The grate consists of a system of alternating stationary and reciprocating lengthwise grate bars, Fig. 2, the stationary bars being numbered "1" and the movable bars, "2".

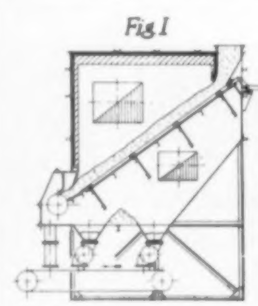
Raw limestone is fed uniformly onto the inclined grate through the hopper at the top. The limestone is conveyed slowly down along the inclined grate by the movement imparted to it by the reciprocating grate bars. During the upward stroke of the slowly reciprocating movement of the grate bars, the material on the grate will remain stationary, the actual movement of the material being accomplished by the downward stroke of these grate bars. At the lower end of the inclined grate is a slowly rotating drum. Its speed determines the rate of movement of limestone.

Discharge openings provided with rotary air seals at the bottom of the preheater housing remove the fine lime dust particles, which may then be fed together with the preheated material to the kiln by means of the conveyor.

The movable grate bars are supported just below the grate on pendulum-like bars which in turn are supported by the preheater housing. These movable grate bars are actuated by a lever system driven by an eccentric. As the upward stroke of the movable grate bars requires more power than the downward stroke, the lever system is counterweighted to compensate for the difference in power.

In an operating test, with the preheater, raw limestone varying in size and having a moisture content from 5 to 15 percent moved uniformly over the inclined grate. The exhaust gases from the rotary kiln utilized in preheating had a temperature of about 1100 deg. F. above the limestone layer, and were cooled down to a temperature of about 400 deg. during the preheating. Material on the grate had an average thickness of 13 in., and the pressure loss occurring during passage of the hot gases was about 2½-in. water column.

Figs. 3 and 4 show the apparatus as designed for use as a cement clinker cooler. Like the preheater, movement is imparted to the material by means of a system of levers parallel to each other and rather widely spaced. The lever system is distributed over the full grate area and reciprocates slowly in a direction parallel to the inclined grate.



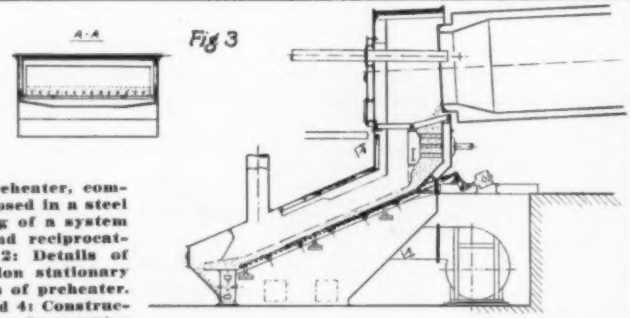
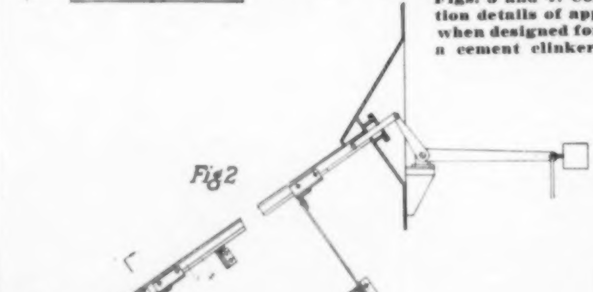
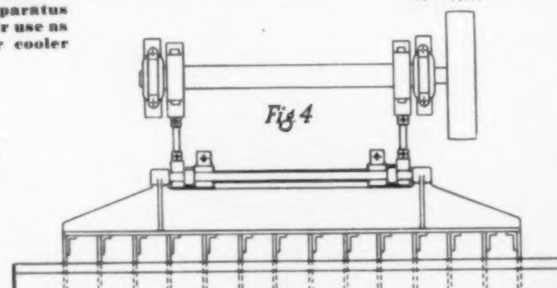


Fig. 1: Rotary lime kiln preheater, comprises an inclined grate enclosed in a steel housing, the grate consisting of a system of alternating stationary and reciprocating lengthwise bars. Fig. 2: Details of construction, showing position stationary and reciprocating grate bars of preheater. Figs. 3 and 4: Construction details of apparatus when designed for use as a cement clinker cooler





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Iowa Mfg. Co.
Jaeger Machine Co.
Jeffrey Mfg. Co.
Lewistown Fdry. & Machine Co.
Link-Belt Co.
McLanahan & Stone Corp.
Pioneer Engineering Works
Robins Conveyng Belt Co.
Smidth, F. L., & Co.
Smith Engineering Works
Traylor Engr. & Mfg. Co.

Buckets (Dragline & Slackline)
Austin-Western Road Machy. Co.
Besser Mfg. Co.
Blaw-Knox Co.
Bucyrus-Erie Co.
Hayward Co.
Hendrick Mfg. Co.
Iowa Mfg. Co.
Link-Belt Co.
Pioneer Engineering Works
Sauerman Bros., Inc.

Buckets (Dredge & Excavator)
Blaw-Knox Co.
Bucyrus-Erie Co.
Hayward Co.
Hendrick Mfg. Co.

Buckets (Dump)
Dempster Bros., Inc.
Jaeger Machine Co.

Building Tile Machines
Besser Mfg. Co.
Multiplex Concrete Machy. Co.
Stearns Mfg. Co.

Bulk Cement Batching Plants
Heltzel Steel Form & Iron Co.

Bulk Cement Storage Plants
Blaw-Knox Co.
Heltzel Steel Form & Iron Co.
Jeffrey Mfg. Co.
Link-Belt Co.
Smidth, F. L., & Co.

Bulldozers
Blaw-Knox Co.
Bucyrus-Erie Co.
Koehring Co.

Bullscrapers
Bucyrus-Erie Co.

Bushings
Eagle Iron Works
Jeffrey Mfg. Co.
Link-Belt Co.

Cables (Electric)
General Electric Co.

Cableways
American Cable Co.
Bethlehem Steel Co.
Blaw-Knox Co.
Bucyrus-Erie Co.
Hazard Wire Rope Co.
Leschen, A., & Sons, Rope Co.
Link-Belt Co.
Roebling's, John A., Sons Co.
Sauerman Bros., Inc.

Calcining Equipment
Allis-Chalmers Co.
Blaw-Knox Co.
Manitowoc Engineering Works
Smidth, F. I., & Co.
Traylor Engr. & Mfg. Co.

Capacitators
General Electric Co.

Capstans
Jeffrey Mfg. Co.
Link-Belt Co.
Robins Conveying Belt Co.

Car Couplings and Hitches
Easton Car & Construction Co.

Car Dumpers
Eagle Iron Works
Easton Car & Construction Co.
Link-Belt Co.
Traylor Engr. & Mfg. Co.

Car Pullers & Movers
American Hoist & Derrick Co.
Jeffrey Mfg. Co.
Link-Belt Co.
Robins Conveying Belt Co.

Cars (Industrial, Quarry, Dump, Concrete, Block, etc.)
Austin-Western Road Machy. Co.
Besser Mfg. Co.
Bethlehem Steel Co.
Chase Foundry & Mfg. Co.
Eagle Iron Works
Easton Car & Construction Co.
Link-Belt Co.
Multiplex Concrete Machy. Co.
Sanford-Day Iron Works
Stearns Mfg. Co.
Traylor Engr. & Mfg. Co.

Car Wheels
Bethlehem Steel Co.
Chase Foundry & Mfg. Co.
Eagle Iron Works
Easton Car & Construction Co.
Iowa Mfg. Co.
Link-Belt Co.

"We've cut maintenance costs 66⅔% with GULF'S HIGHER QUALITY DIESEL LUBRICANTS"

...SAYS THIS PLANT SUPERINTENDENT

"Now we go through our heavy summer season without frequent shutdowns for repairs"

"WE'RE through making repairs on hot engines in warm weather," says this plant superintendent. "Since we've standardized on Gulf lubricants we've cut our repair expenses 66⅔%, and have avoided the annoyance of engine troubles during our busy summer season."

Have you found it necessary to pull pistons, clean carbon, rings and exhaust ports too frequently? You can get the same freedom from engine troubles that this operator enjoys if you will call in a Gulf engineer and ask him to recommend the lubricants best suited to your equipment. Gulf's higher quality Diesel oils are manufactured to provide an extra margin of operating safety, insuring full protection against engine troubles which might develop because of ineffective lubrication.

No matter where your plant is located, Gulf products are quickly available to you through more than 1100 warehouses in 28 states from Maine to Texas. Talk with the Gulf engineer when he calls. He can give you valuable assistance—and you will be under no obligation.

GULF OIL CORPORATION • GULF REFINING COMPANY

GENERAL OFFICES, GULF BUILDING, PITTSBURGH, PA.

GULF INDUSTRIAL LUBRICATION

Classified Directory (Cont.)

Carts
Blaw-Knox Co.
Jaeger Machine Co.
Link-Belt Co.
Robins Conveying Belt Co.

Castings
Allis-Chalmers Mfg. Co.
Babcock & Wilcox Co.
Bacon, Earle C., Inc.
Bethlehem Steel Co.
Blaw-Knox Co.
Chicago Steel Foundry Co.
Dixie Machinery Mfg. Co.
Eagle Iron Works
Frog, Switch & Mfg. Co.
Hetherington & Bener, Inc.
Iowa Mfg. Co.
Jeffrey Mfg. Co.
Lima Locomotive Works, Inc. (Shovel & Crane Div.)
Link-Belt Co.
McLanahan & Stone Corp.
Manitowoc Engineering Works
Robins Conveying Belt Co.
Smidth, F. L., & Co.
Timken Roller Bearing Co.
Traylor Engr. & Mfg. Co.
Wall-Colmonoy Corp.

Cement Colors
Mepham, Geo. S., Corp.

Cement Plants
Allis-Chalmers Mfg. Co.
Smidth, F. L., & Co.
Traylor Engr. & Mfg. Co.

Cement Process
Cement Process Corp.

Cement Pumps
Fuller Co.
Smidth, F. L., & Co.

Central Mixing Plants (Concrete)
Blaw-Knox Co.
Heltzel Steel & Iron Co.
Jaeger Machine Co.

Chain (Conveyor & Elevator)
Bacon, Earle C., Inc.
Jeffrey Mfg. Co.
Link-Belt Co.

Chain (Dredge & Shovel)
Bucyrus-Erie Co
Iowa Mfg. Co.
Jeffrey Mfg. Co.
Link-Belt Co.

Chimney Block Machine & Molds
Besser Co.
Multiplex Concrete Machy. Co.

Chutes (Bin, Concrete, etc.)
Allis-Chalmers Mfg. Co
Austin-Western Road Machy. Co.
Bacon, Earle C., Inc.
Blaw-Knox Co.
Chicago Bridge & Iron Co.
Cross Engineering Co.
Eagle Iron Works
Fuller Co.
Hendrick Mfg. Co
Iowa Mfg. Co.
Jaeger Machine Co.
Jeffrey Mfg. Co.
Link-Belt Co.
McLanahan & Stone Corp.
Northern Blower Co.
Pioneer Engineering Works
Robins Conveying Belt Co
Ross Screen & Feeder Co.
Smidth, F. L., & Co.
Traylor Engr. & Mfg. Co.

Chute Liners
Bacon, Earle C., Inc.
Cross Engineering Co
Frog, Switch & Mfg. Co.
Hendrick Mfg. Co.
Iowa Mfg. Co.
Jeffrey Mfg. Co.
Link-Belt Co.
McLanahan & Stone Corp
Robins Conveying Belt Co.
Smidth, F. L., & Co.

Circuit Breakers
Allis-Chalmers Mfg. Co.
General Electric Co.

Circuit Testers
Atlas Powder Co.
General Electric Co.
Hercules Powder Co.

Clarifiers
Hardinge Co., Inc.
Jeffrey Mfg. Co.
Link-Belt Co.

Classifiers
Allis-Chalmers Mfg. Co.
Blaw-Knox Co.
Deister Machine Co.
Eagle Iron Works
Iowa Mfg. Co.
Jeffrey Mfg. Co.
Lewistown Fdry. & Machy. Co.
Link-Belt Co.
Nordberg Mfg. Co.
Northern Blower Co.
Pioneer Engineering Works, Inc.
Raymond Pulverizer Div.
Research Corp.
Sly, W. W., Mfg. Co.
Smidth, F. L., & Co.
Traylor Engr. & Mfg Co.
Universal Vibrating Screen Co.
Western Precipitation Co.
Williams Patent Crusher & Pulv. Co.

Clutches
Allis-Chalmers Mfg. Co.
Jeffrey Mfg. Co.
Link-Belt Co.

Coal Pulverizing Equipment
Allis-Chalmers Mfg Co.
Austin-Western Road Machy. Co.
Babcock & Wilcox Co.
Combustion Engr. Corp.
Jeffrey Mfg. Co.
Pennsylvania Crusher Co.
Raymond Pulverizer Div
Smidth, F. L., & Co.
Traylor Engr. & Mfg. Co.
Williams Patent Crusher & Pulv. Co.

Concentrators
Deister Machine Co.

Concrete Mixers
Anchor Concrete Machy. Co.
Besser Mfg. Co.
Blaw-Knox Co.
Jaeger Machine Co.
Jeffrey Mfg. Co.
Kent Machine Co.
Koehring Co.
Multiplex Concrete Machy. Co.
Stearns Mfg. Co.

Controllers (Electric)
Allis-Chalmers Mfg. Co.
General Electric Co.

Converters (Electric)
Allis-Chalmers Mfg. Co.
General Electric Co.

Conveyor Idlers & Rolls
Austin-Western Road Machy. Co.
Bacon, Earle C., Inc.
Barber-Greene Co.
Iowa Mfg. Co.
Jeffrey Mfg. Co.
Link-Belt Co.
Pioneer Engr. Works, Inc.
Robins Conveying Belt Co.
Smidth, F. L., & Co.

Conveyors (Apron)
Allis-Chalmers Mfg. Co.
Barber-Greene Co.
Jeffrey Mfg. Co.
Link-Belt Co.
Robins Conveying Belt Co.
Traylor Engr. & Mfg. Co.

Conveyors (Belt)
Allis-Chalmers Mfg. Co.
Austin-Western Road Machy. Co.
Bacon, Earle C., Inc.
Barber-Greene Co.
Besser Mfg. Co.
Chicago Steel Foundry Co.
Fuller Co.
Gay, Rubert M., Div.
Hendrick Mfg. Co.
Industrial Brownhoist Corp.
Iowa Mfg. Co.
Jeffrey Mfg. Co.
Lewistown Fdry. & Machine Co.
Link-Belt Co.
McLanahan & Stone Corp.
Multiplex Concrete Machy. Co.
Pioneer Engineering Works, Inc.
Robins Conveying Belt Co.
Smidth, F. L., Co.
Smith Engineering Works
Stearns Mfg. Co.
Syntron Co.
Traylor Engineering & Mfg. Co.
Universal Road Machy. Co.
Williams Patent Crusher & Pulv. Co.

Conveyors (Drag-Chain)
Jeffrey Mfg. Co.
Link-Belt Co.

Conveyors (Pan)
Allis-Chalmers Mfg. Co.
Jeffrey Mfg. Co.
Link-Belt Co.

Conveyors (Pneumatic)
Fuller Co.
Northern Blower Co.
Raymond Pulverizer Div.

Classified Directory (Cont.)

Conveyors (Portable)
Austin-Western Road Machy. Co.
Barber-Greene Co.
Fuller Co.
Jeffrey Mfg. Co.
Link-Belt Co.
Pioneer Engineering Works, Inc.
Robins Conveying Belt Co.

Conveyors (Screw)
Besser Mfg. Co.
Eagle Iron Works
Jeffrey Mfg. Co.
Link-Belt Co.
Northern Blower Co.

Conveyors (Trolley)
Jeffrey Mfg. Co.
Link-Belt Co.
Stearns Mfg. Co.

Conveyors (Vibrating)
Allis-Chalmers Mfg. Co.
Jeffrey Mfg. Co.
Link-Belt Co.
Smidth, F. L., & Co.
Syntron Co.

Coolers
Allis-Chalmers Mfg. Co.
Blaw-Knox Co.
Chicago Bridge & Iron Co.
Jeffrey Mfg. Co.
Link-Belt Co.
Manitowoc Engineering Works
Northern Blower Co.
Smidth, F. L., & Co.
Traylor Engr. & Mfg. Co.

Coolers (Clinker)
Fuller Co.
Smidth, F. L., & Co.
Traylor Engr. & Mfg. Co.

Correcting Basins
Smidth, F. L., & Co.

Cottrell Precipitators
Research Corp.
Western Precipitation Co.

Couplings (Flexible & Shaft)
Allis-Chalmers Mfg. Co.
Jeffrey Mfg. Co.
Link-Belt Co.
Robins Conveying Belt Co.

Cranes (Diesel, Electric, Gasoline, Steam)
American Hoist & Derrick Co.
Austin-Western Road Machy. Co.
Bucyrus-Erie Co.
Industrial Brownhoist Corp.
Koehring Co.
Lima Locomotive Works, Inc. (Shovel & Crane Div.)
Link-Belt Speeder Corp.
Manitowoc Engineering Works
Marion Steam Shovel Co.
Northwest Engineering Co.
Thew Shovel Co.

Cranes (Overhead Traveling)
Industrial Brownhoist Corp.

Cranes (Tractor)
Austin-Western Road Machy. Co.
Bucyrus-Erie Co.
Koehring Co.
Lima Locomotive Works, Inc. (Shovel & Crane Div.)
Link-Belt Speeder Corp.

Cranes (Truck)
Link-Belt Speeder Corp.
Thew Shovel Co.

Crawler Attachments
Allis-Chalmers Mfg. Co.
Link-Belt Co.

Crawling Tractor Excavators
Austin-Western Road Machy. Co.
Koehring Co.
Link-Belt Co.
Thew Shovel Co.

Crusher Parts
Allis-Chalmers Mfg. Co.
American Pulverizer Co.
Bacon, Earle C., Inc.
Dixie Machinery Mfg. Co.
Eagle Iron Works
Frog, Switch & Mfg. Co.
Iowa Mfg. Co.
Jeffrey Mfg. Co.
McLanahan & Stone Corp.
Pennsylvania Crusher Co.
Pioneer Engineering Works, Inc.
Traylor Engr. & Mfg. Co.

Crushers (Cone)
Nordberg Mfg. Co.

Crushers (Hammer)
Allis-Chalmers Mfg. Co.
American Pulverizer Co.
Austin-Western Road Machy. Co.
Dixie Machinery Mfg. Co.
Jeffrey Mfg. Co.
Pennsylvania Crusher Co.
Williams Patent Crusher & Pulv. Co.

Crushers (Jaw & Gyratory)
Allis-Chalmers Mfg. Co.
Austin-Western Road Machy. Co.
Bacon, Earle C., Inc.
Dixie Machinery Mfg. Co.
Iowa Mfg. Co.
Jeffrey Mfg. Co.
Lewistown Fdry. & Machine Co.
McLanahan & Stone Corp.
Nordberg Mfg. Co.
Pennsylvania Crusher Co.
Pioneer Engineering Works, Inc.
Smith Engineering Works
Traylor Engineering & Mfg. Co.
Universal Road Machinery Co.

Crushers (Laboratory)
Allis-Chalmers Mfg. Co.
American Pulverizer Co.
Bacon, Earle C., Inc.
Dixie Machinery Mfg. Co
Jeffrey Mfg. Co.
Pennsylvania Crusher Co.
Traylor Engineering & Mfg Co.
Williams Patent Crusher & Pulv. Co.

Crushers (Primary Breakers)
Allis-Chalmers Mfg. Co.
McLanahan & Stone Corp.
Smith Engineering Works
Traylor Engr. & Mfg. Co.
Williams Patent Crusher & Pulv. Co.

Crushers Reduction
Allis-Chalmers Mfg. Co.
Austin-Western Road Machy. Co.
Bacon, Earle C., Inc.
Iowa Mfg. Co.
Jeffrey Mfg. Co.
McLanahan & Stone Corp.
Smith Engineering Works
Traylor Engr. & Mfg. Co.

Crushers (Ring)
American Pulverizer Co.
Dixie Machinery Mfg. Co.
Jeffrey Mfg. Co.
Williams Patent Crusher & Pulv. Co.

Crushers (Roll)
Allis-Chalmers Mfg. Co.
American Pulverizer Co.
Austin-Western Road Machy. Co.
Babcock & Wilcox Co.
Bacon, Earle C., Inc.
Besser Mfg. Co.
Eagle Iron Works
Jeffrey Mfg. Co.
Link-Belt Co.
McLanahan & Stone Corp.
Pennsylvania Crusher Co.
Pioneer Engr. Works, Inc.
Robins Conveying Belt Co.
Smith Engineering Works
Traylor Engr. & Mfg. Co.
Williams Patent Crusher & Pulv. Co.

Crushing Rolls
Allis-Chalmers Mfg. Co.
Austin-Western Road Machy. Co.
Eagle Iron Works
Jeffrey Mfg. Co.
Link-Belt Co.
McLanahan & Stone Corp.
Pennsylvania Crusher Co.
Pioneer Engineering Works, Inc.
Traylor Engr. & Mfg. Co.
Williams Patent Crusher & Pulv. Co.

Crushing & Screening Plants (Portable)
Allis-Chalmers Mfg. Co.
American Pulverizer Co.
Austin-Western Road Machy. Co.
Bacon, Earle C., Inc.
Barber-Greene Co.
Blaw-Knox Co.
Dixie Machy. Mfg. Co.
Eagle Iron Works
Heltzel Steel Form & Iron Co.

Classified Directory (Cont.)

Iowa Mfg. Co.
Jeffrey Mfg. Co.
Link-Belt Co.
McLanahan & Stone Corp.
Pennsylvania Crusher Co.
Pioneer Engr. Works, Inc.
Smith Engr. Works
Traylor Engr. & Mfg. Co.
Universal Vibrating Screen Co.
Williams Patent Crusher & Pulv. Co.

Curing Racks
Besser Mfg. Co.
Chase Foundry & Mfg. Co.
Multiplex Concrete Machy. Co.
Stearns Mfg. Co.

Decks, Vibrating Screen
Hendrick Mfg. Co.

Dedusters
Blaw-Knox Co.
Western Precipitation Co.

Dehydrators
Pioneer Engineering Works, Inc.

Derricks
American Hoist & Derrick Co.
Hayward Co.
Manitowoc Engineering Works

Detonators
Atlas Powder Co.
Ensign-Bickford Co.
Hercules Powder Co.

Dewatering Equipment
Allis-Chalmers Mfg. Co.
Diamond Iron Works, Inc.
Eagle Iron Works
Jaeger Machine Co.
Jeffrey Mfg. Co.
Link-Belt Co.

Diaphragms (Rubber)
Jaeger Machine Co.

Dippers & Teeth (Dredge & Shovel)
Bucyrus-Erie Co.
Frog, Switch & Mfg. Co.
Koehring Co.
Link-Belt Co.
Marion Steam Shovel Co.
Thew Shovel Co.

Disintegrators
Smidth, F. L., & Co.

Ditchers
Barber-Greene Co.
Bucyrus-Erie Co.
Link-Belt Co.
Marion Steam Shovel Co.

Dragline & Cableway Excavators
American Cable Co.
American Hoist & Derrick Co.
Austin-Western Road Machy. Co.
Blaw-Knox Co.
Bucyrus-Erie Co.
Koehring Co.
Lima Locomotive Works, Inc. (Shovel & Crane Div.)
Link-Belt Speeder Corp.
Marion Steam Shovel Co.
Northwest Engineering Co.
Pioneer Engr. Works, Inc.
Sauerman Bros., Inc.
Thew Shovel Co.

Dredge Cutter Heads & Ladders
Bucyrus-Erie Co.
Eagle Iron Works
Hetherington & Berner, Inc.

Dredge Hulls
Chicago Bridge & Iron Co.
Eagle Iron Works
Manitowoc Engineering Works

Dredges
American Hoist & Derrick Co.
Bucyrus-Erie Co.
Eagle Iron Works
Hayward Co.
Hetherington & Berner, Inc.
Link-Belt Co.
Manitowoc Engineering Works
Marion Steam Shovel Co.

Dredge Sleeves
Hetherington & Berner, Inc.
Thermoid Rubber Co.

Drilling Accessories
Bucyrus-Erie Co.
Gardner-Denver Co.
Timken Roller Bearing Co.

Drill Bits
Bucyrus-Erie Co.
Timken Roller Bearing Co.

Drill Sharpening Machines
Bucyrus-Erie Co.
Gardner-Denver Co.

Drill Steel
Bethlehem Steel Co.
Gardner-Denver Co.

Drills (Blast Hole)
Bucyrus-Erie Co.
Gardner-Denver Co.

Drills (Hand Hammer)
Gardner-Denver Co.

Drills (Rock)
Bucyrus-Erie Co.
Gardner-Denver Co.
Jeffrey Mfg. Co.
Syntron Co.
Timken Roller Bearing Co.

Drills (Wagon)
Gardner-Denver Co.

Drills (Well)
Bucyrus-Erie Co.

Drives (Belt Chain & Rope)
Allis-Chalmers Mfg. Co.
Bacon, Earle C., Inc.
Jeffrey Mfg. Co.
Link-Belt Co.
Smidth, F. L., & Co.

Drives (Short-Center)
Allis-Chalmers Mfg. Co.
Bacon, Earle C., Inc.
Link-Belt Co.
Smidth, F. L., & Co.

Drives (Worm)
Link-Belt Co.

Dryers
Allis-Chalmers Mfg. Co.
Babcock & Wilcox Co.
Blaw-Knox Co.
Chicago Bridge & Iron Co.
Combustion Engr. Co.
Hetherington & Berner, Inc.
Iowa Mfg. Co.
Jeffrey Mfg. Co.
Lewistown Fdy. & Mach. Co.
Link-Belt Co.
McLanahan & Stone Corp.
Manitowoc Engineering Works
Raymond Pulverizer Div.
Smidth, F. L., & Co.
Traylor Engr. & Mfg. Co.
Tyler, W. S., Co.
Western Precipitation Co.
Williams Patent Crusher & Pulv. Co.

Dust Arrestors
Blaw-Knox Co.
Research Corp.
Western Precipitation Co.

Dust Collecting Systems
Allis-Chalmers Mfg. Co.
Blaw-Knox Co.
Buell Engineering Co., Inc.
Chicago Bridge & Iron Co.
Hendrick Mfg. Co.
Northern Blower Co.
Raymond Pulverizing Div.
Research Corp.
Sly, W. W., Mfg. Co.
Smidth, F. L., & Co.
Western Precipitation Co.

Dust Collecting Bags
Blaw-Knox Co.
Sly, W. W., Mfg. Co.

Dust Conveying Systems
Allis-Chalmers Mfg. Co.
Blaw-Knox Co.
Fuller Co.
Raymond Pulverizer Div.
Research Corp.
Sly, W. W., Mfg. Co.
Western Precipitation Co.

Dust Precipitators
Research Corp.
Western Precipitation Co.

Dust Recovery Plants
Research Corp.
Sly, W. W., Mfg. Co.
Western Precipitation Co.

Dynamite
Atlas Powder Co.
Hercules Powder Co.

Electric Cables
General Electric Co.

Electric Motors
Allis-Chalmers Mfg. Co.
General Electric Co.
Hayward Co.

Electric Motor Starters
Allis-Chalmers Mfg. Co.
General Electric Co.

Elevators
Allis-Chalmers Mfg. Co.
Austin-Western Road Machy. Co.
Bacon, Earle C., Inc.
Barber-Greene Co.
Besser Mfg. Co.
Chicago Steel Fdry. Co.
Eagle Iron Works
Fuller Co.
Gay, Rubert M., Div.
Hendrick Mfg. Co.
Industrial Brownhoist Corp.
Iowa Mfg. Co.
Jaeger Machine Co.
Jeffrey Mfg. Co.

Classified Directory (Cont.)

Kent Machine Co.
Lewistown Fdy. & Machine Co.
Link-Belt Co.
McLanahan & Stone Corp.
Multiplex Concrete Machy. Co.
Pioneer Engineering Works, Inc.
Robins Conveying Belt Co.
Smidth, F. L., & Co.
Smith Engineering Works
Stearns Mfg. Co.
Syntron Co.
Traylor Engr. & Mfg. Co.
Universal Road Machy. Co.
Williams Patent Crusher & Pulv. Co.

Engineers (Designing & Consulting)
Allis-Chalmers Mfg. Co.
Bacon, Earle C., Inc.
Blaw-Knox Co.
Fuller Co.
Hetherington & Berner, Inc.
Iowa Mfg. Co.
Jeffrey Mfg. Co.
Link-Belt Co.
McLanahan & Stone Corp.
Merrick Scale Co.
Northern Blower Co.
Robins Conveying Belt Co.
Smidth, F. L., & Co.
Traylor Engr. & Mfg. Co.
Williams Patent Crusher & Pulv. Co.

Engines (Diesel, Gas, Kerosene & Oil)
Allis-Chalmers Mfg. Co.
American Hoist & Derrick Co.
Caterpillar Tractor Co.
Cummins Engine Co. (Diesel)
Iowa Mfg. Co.
National Supply Co.
Nordberg Mfg. Co.
Superior Diesel

Engines (Natural Gas)
Allis-Chalmers Mfg. Co.

Engines (Steam)
Allis-Chalmers Mfg. Co.
American Hoist & Derrick Co.
Nordberg Mfg. Co.

Exhausters
Combustion Engr. Co.
Raymond Pulverizer Div.

Explosives
Atlas Powder Co.
Hercules Powder Co.

Fans
Blaw-Knox Co.
General Electric Co.
Jeffrey Mfg. Co.
Northern Blower Co.
Sly, W. W., Mfg. Co.
Smidth, F. L., & Co.

Feeders
Allis-Chalmers Mfg. Co.
Babcock & Wilcox Co.
Bacon, Earle C., Inc.
Barber-Greene Co.
Besser Mfg. Co.
Blaw-Knox Co.
Fuller Co.
Gay, Rubert M., Div.
Hetherington & Berner, Inc.
Iowa Mfg. Co.
Jeffrey Mfg. Co.
Kent Machine Co.
Link-Belt Co.
McLanahan & Stone Corp.
Merrick Scale Mfg. Co.
Northern Blower Co.
Pennsylvania Crusher Co.
Pioneer Engr. Works, Inc.
Robins Conveying Belt Co.
Ross Screen & Feeder Co.
Schaffer Poidometer Co.
Smidth, F. L., & Co.
Smith Engineering Works
Stearns Mfg. Co.
Syntron Co.
Traylor Engr. & Mfg. Co.
Universal Road Machy. Co.

Filter Cloth
Northern Blower Co.
Roeblings, John A., Sons Co.
Tyler, W. S., Co.

Finished Cement Grinding Aid
Dewey & Almy Chemical Co.

Fly Ash Collectors
Research Corp.
Western Precipitation Co.

Forges
Gardner-Denver Co.

Forgings
Allis-Chalmers Mfg. Co.
Bacon, Earle C., Inc.
Laughlin, Thomas, Inc.

Frogs & Switches
Easton Car & Construction Co.
Frog, Switch & Mfg. Co.

Fuels (Diesel)
Texas Co.

Fume Collectors
Research Corp.
Western Precipitation Co.

Furnaces (Heat Treating, Electric)
General Electric Co.

Fuse Cutouts
General Electric Co.

Fuse Cutters
Ensign-Bickford Co.

Fuse Lighters
Ensign-Bickford Co.

Fuses (Detonating & Safety)
Atlas Powder Co.
Ensign-Bickford Co.
Hercules Powder Co.

Fuses (Electric)
General Electric Co.

Galvanometers
General Electric Co.
Hercules Powder Co.

Gasoline
Gulf Refining Co.
Texas Co.

Gas Producers
Blaw-Knox Co.

Gas Scrubbers
Research Corp.
Western Precipitation Co.

Gear-Motors
Allis-Chalmers Mfg. Co.
General Electric Co.
Link-Belt Co.

Gears
Allis-Chalmers Mfg. Co.
Bacon, Earle C., Inc.
Frog, Switch & Mfg. Co.
General Electric Co.
Jeffrey Mfg. Co.
Link-Belt Co.
Robins Conveying Belt Co.
Traylor Engr. & Mfg. Co.

Generator & Motor Generator Sets
Allis-Chalmers Mfg. Co.
General Electric Co.
National Supply Co.
Nordberg Mfg. Co.
Superior Diesel
Syntron Co.

Glass Sand Equipment
Lewistown Fdry. & Mach. Co.

Gloves
Sly, W. W., Mfg. Co.

Grapples
Blaw-Knox Co.
Bucyrus-Erie Co.
Hayward Co.
Owen Bucket Co.

Grating
Blaw-Knox Co.
Eagle Iron Works
Hendrick Mfg. Co.

Grease
Bacon, Earle C., Inc.
Gulf Refining Co.
Texas Co.

Grease Cups
Link-Belt Co.
Robins Conveying Belt Co.

Guards (Lamp)
Flexible Steel Lacing Co.

Guards (Machinery)
Harrington & King Perf. Co.
Hendrick Mfg. Co.
Tyler, W. S., Co.

Guns
Hetherington & Berner, Inc.

Gypsum Plants
Traylor Engr. & Mfg. Co.

Hangers, Anchors & Inserts (Concrete)
Allis-Chalmers Mfg. Co.
Jeffrey Mfg. Co.
Link-Belt Co.

Haulage Systems (Electric)
General Electric Co.
Jeffrey Mfg. Co.

Haulage Systems (Remote Control)
Dempster Bros.
General Electric Co.
Koehring Co.

Heaters (Bitumen)
Easton Car & Construction Co.

Helmets
Sly, W. W., Mfg. Co.

Hoists (Chain, Electric, Skip, Portable, Air, etc.)
Allis-Chalmers Mfg. Co.
American Hoist & Derrick Mfg. Co.
Besser Mfg. Co.
Chase Foundry & Mfg. Co.
Commercial Shearing & Stamping Co.
Eagle Iron Works
Easton Car & Construction Co.
Gardner-Denver Co.

Classified Directory (Cont.)

Gay, Rubert M., Div.
Hetherington & Berner, Inc.
Iowa Mfg. Co.
Jaeger Machine Co.
Jeffrey Mfg. Co.
Link-Belt Co.
McLanahan & Stone Corp.
Nordberg Mfg. Co.
Northwest Engineering Co.
Pioneer Engr. Works, Inc.
Robins Conveying Belt Co.
Sauerman Bros., Inc.
Smith Engineering Works
Stearns Mfg. Co.
Traylor Engr. & Mfg. Co.
Universal Road Machy. Co.

Hoppers
Austin-Western Road Machy. Co.
Besser Mfg. Co.
Blaw-Knox Co.
Chicago Bridge & Iron Co.
Gay, Rubert M., Div.
Heltzel Steel Form & Iron Co.
Hendrick Mfg. Co.
Jaeger Machine Co.
Jeffrey Mfg. Co.
Link-Belt Co.
Merrick Scale Co.
Pioneer Engr. Wks., Inc.
Robins Conveying Belt Co.
Traylor Engr. & Mfg. Co.
Universal Road Machy. Co.

Hose (Air, Drill, Water, Steam, Sand Suction & Discharge)
Dixie Machinery Co.
Hetherington & Berner, Inc.
Jaeger Machine Co.
Sly, W. W., Mfg. Co.

Hose Couplings
Manitowoc Engineering Works

Hose (Sand Blast)
Sly, W. W., Mfg. Co.

Hydrators
Blaw-Knox Co.
Chicago Bridge & Iron Co. (Lime)
Traylor Engr. & Mfg. Co.

Jigs (Sand & Gravel)
Allis-Chalmers Mfg. Co.
Traylor Engr. & Mfg. Co.

Joists & Slab Machines (Concrete)
Besser Mfg. Co.

Kiln Burners
Babcock & Wilcox Co.
Smidth, F. L., & Co.

Kiln Chain Systems
Smidth, F. L., & Co.

Kiln Liners
Traylor Engr. & Mfg. Co.

Kiln Parts
Allis-Chalmers Mfg. Co.
Blaw-Knox Co.
Chicago Steel Foundry Co.
Manitowoc Engineering Works
Smidth, F. L., & Co.
Traylor Engr. & Mfg. Co.

Kilns (Rotary)
Allis-Chalmers Mfg. Co.
Blaw-Knox Co.
Chicago Bridge & Iron Co.
Manitowoc Engineering Works
Smidth, F. L., & Co.
Traylor Engineering & Mfg. Co.

Kilns (Vertical)
Blaw-Knox Co.
Chicago Bridge & Iron Co.

Kominuters
Smidth, F. L., & Co.

Laboratory Apparatus
Smidth, F. L., & Co.

Lift Trucks
Besser Mfg. Co.
Stearns Mfg. Co.

Lime Handling Equipment
Chicago Bridge & Iron Co.
Combustion Engr. Corp.
Fuller Co.
Iowa Mfg. Co.
Jeffrey Mfg. Co.
Link-Belt Co.
Raymond Pulv. Div.
Robins Conveying Belt Co.
Traylor Engr. & Mfg. Co.

Lime Plants
Allis-Chalmers Mfg. Co.
American Pulv. Co.
Blaw Knox
Chicago Bridge & Iron Co.
Manitowoc Engineering Works
Smidth, F. L., & Co.
Traylor Engr. & Mfg. Co.

Lime Putty Plants
Chicago Bridge & Iron Co.

Loaders (Boat)
Fuller Co.
Link-Belt Co.

Loaders (Box Car)
Barber-Greene Co.
Jeffrey Mfg. Co.
Link-Belt Co.

Loaders (Car, Truck, Bin & Hopper)
Barber-Greene Co.
Besser Mfg. Co.
Bucyrus-Erie Co.
Fuller Co.
Gardner-Denver Co.
Gay, Rubert M. Div.
Jeffrey Mfg. Co.
Link-Belt Co.
Marion Steam Shovel Co.
Northwest Engineering Co.
Robins Conveying Belt Co.
Ross Screen & Feeder Co.
Stearns Mfg. Co.
Universal Road Machy. Co.

Loaders (Underground)
Allis-Chalmers Mfg. Co.
Bucyrus-Erie Co.
Jeffrey Mfg. Co.
Nordberg Mfg. Co.
Thew Shovel Co.

Locomotive Stack Netting
Tyler W. S., Co.

Locomotives (Diesel-Electric)
Davenport-Besler Corp.
Lima Locomotive Works (Loco. Div.)

Locomotives (Electric, Trolley & Storage Battery)
Davenport-Besler Corp.
General Electric Co.
Jeffrey Mfg. Co.
Lima Locomotive Works, Inc. (Loco. Div.)

Locomotives (Gasoline & Gas-Electric)
Davenport-Besler Corp.
General Electric Co.
Jeffrey Mfg. Co.
Lima Locomotive Wks., Inc. (Loco. Div.)

Locomotives (Kerosene)
Lima Locomotive Works, Inc. (Loco. Div.)

Locomotives (Oil & Oil-Electric)
General Electric Co.

Locomotives (Steam)
Davenport-Besler Corp.
Lima Locomotive Works, Inc. (Loco. Div.)

Lubricants
Bacon, Earle C., Inc.
Gulf Refining Co.
Robins Conveying Belt Co.
Texas Co.

Machine Shop Equipment
Robins Conveying Belt Co.
Smidth, F. L., & Co.
Traylor Engr. & Mfg. Co.

Magnetic Separators
Allis-Chalmers Mfg. Co.
Jeffrey Mfg. Co.
Link-Belt Co.
Robins Conveying Belt Co.

Magnets
General Electric Co.

Manganese Steel Parts
Bacon, Earle C., Inc.
Dixie Machy. Mfg. Co.
Frog, Switch & Mfg. Co.

Manhole Block Machines (Concrete)
Stearns Mfg. Co.

Material Handling Equipment
Austin-Western Rd. Machy. Co.
Barber-Greene Co.
Fuller Co.
Heltzel Steel Form & Iron Co.
Jeffrey Mfg. Co.
Link-Belt Co.
Northern Blower Co.
Raymond Pulv. Div.
Robins Conveying Belt Co.
Syntron Co.

Measuring Devices
Blaw-Knox Co.
Fuller Co.
General Electric Co.
Heltzel Steel Form & Iron Co.
Jaeger Machine Co.
Schaffer Poidometer Co.

Mechanical Rubber Goods . .
Thermoid Rubber Co.

Mill Liners
Allis-Chalmers Mfg. Co.
Babcock & Wilcox Co.
Dixie Machy. Mfg. Co.
Jeffrey Mfg. Co.
Smidth, F. L., & Co.
Traylor Engr. & Mfg. Co.

Classified Directory (Cont.)

Mill Parts
Allis-Chalmers Mfg. Co.
Blaw-Knox Co.
Smidth, F. L., & Co.
Traylor Engr. & Mfg. Co.

Mills, Grinding (Ball, Compartment, Emery, Hammer, Pug, Rod, Roll, Tube, etc.) (See Pulverizers also)
Allis-Chalmers Mfg. Co.
American Puverizing Co.
Babcock & Wilcox Co.
Dixie Machinery Mfg. Co.
Jeffrey Mfg. Co.
Lewistown Fdy. & Machy. Co.
Pennsylvania Crusher Co.
Raymond Pulverizer Div.
Smidth, F. L., & Co.
Traylor Engr. & Mfg. Co.
Williams Patent Crusher & Pulv. Co.

Mortar Mixers
Eagle Iron Works
Jaeger Machine Co.

Nozzles (Sand Blast)
Sly, W. W., Mfg. Co.

Nozzles (Washing)
Deister Machine Co.
Link-Belt Co.

Nuts
Bethlehem Steel Co.

Oil Burners
Smidth, F. L., & Co.

Oils (Cutting)
Texas Co., The

Oils (Lubricating)
Bacon, Earle C., Inc.
Gulf Refining Co.
Robins Conveying Belt Co.
Texas Co., The

Outdoor Lighting Equipment
General Electric Co.

Packing
Thermoid Rubber Co.

Pallets (Steel & Wood)
Anchor Concrete Machinery Co.
Bacon, Earle C., Inc.
Besser Mfg. Co.
Chase Foundry & Mfg. Co.
Commercial Shearing & Stamping Co.
Multiplex Concrete Machy. Co.
Stearns Mfg. Co.

Pans, Grinding (Wet & Dry)
Eagle Iron Wks.
McLanahan & Stone Corp.
Traylor Engr. & Mfg. Co.

Perforated Metal
Allis-Chalmers Mfg. Co.
Bacon, Earle C., Inc.
Chicago Perforating Co.
Harrington & King Perf. Co.
Hendrick Mfg. Co.
Jeffrey Mfg. Co.
Link-Belt Co.
Pioneer Engr. Wks., Inc.
Robins Conveying Belt Co.
Ryerson, Jos. T., & Son, Inc.
Traylor Engr. & Mfg. Co.

Pinions
Bacon, Earle C., Inc.
Frog, Switch & Mfg. Co., The
General Electric Co.
Jeffrey Mfg. Co., The
Link-Belt Co.

Pipe
Bethlehem Steel Co.
Chicago Bridge & Iron Co.
Frog, Switch & Mfg. Co., The
Hetherington & Berner, Inc.

Pipe Fittings
Hetherington & Berner, Inc.

Pipe, Forms & Machine (Concrete)
Besser Mfg. Co.
Stearns Mfg. Co.

Plaster Mixers
Eagle Iron Works
Jaeger Machine Co.

Plaster Plants
Koehring Co.

Poidometers
Schaffer Poidometer Co.

Pontoons
Chicago Bridge & Iron Co.
Eagle Iron Wks.
Manitowoc Engineering Works

Powder (Blasting)
Atlas Powder Co.
Hercules Powder Co.

Powder Magazines
Hercules Powder Co.

Power Transmission Machinery
Allis-Chalmers Mfg. Co.
Jeffrey Mfg. Co., The
Link-Belt Company
Robins Conveying Belt Co.
Smidth, F. L., & Co.
Timken Roller Bearing Co., The

Power Units
Allis-Chalmers Mfg. Co.
Caterpillar Tractor Co.
Cummins Engine Co. (Diesel)
Nordberg Mfg. Co.

Precipitators, Cottrell
Research Corp.
Western Precipitation Co.

Pulleys
Allis-Chalmers Mfg. Co.
Bacon, Earle C., Inc.
Jeffrey Mfg. Co.
Link-Belt Co.
McLanahan & Stone Corp.
Robins Conveying Belt Co.

Pulverizer Parts
Allis-Chalmers Mfg. Co.
American Pulv. Co.
Dixie Machinery Mfg. Co.
Frog, Switch & Mfg. Co.
Jeffrey Mfg. Co.
Smidth, F. L., & Co.

Pulverizers (Hammer, Ring, Rod & Roll) (See also Mills & Crushers)
Allis-Chalmers Mfg. Co.
American Pulverizer Co.
Austin-Western Road Machy. Co.
Babcock & Wilcox Co.
Blaw-Knox Co.
Combustion Engr. Corp.
Dixie Machy. Corp.
Gay, Rubert M., Div.
Jeffrey Mfg. Co.
Pennsylvania Crusher Co.
Raymond Pulverizer Div.
Smidth, F. L., & Co.
Traylor Engr. & Mfg. Co.
Universal Road Machy. Co.
Williams Patent Crusher & Pulv. Co.

Pumps (Diaphragm)
Jaeger Machine Co.

Pump Valves (Dry Pulverized Material)
Fuller Co.

Pumps (Dredge)
Allis-Chalmers Mfg. Co.
Bucyrus-Erie Co.
Hetherington & Berner

Pumps (Dry Pulverized Material)
Babcock & Wilcox Co.
Fuller Co., The
Smidth, F. L., & Co.

Pumps (Slurry)
Allis-Chalmers Mfg. Co.
Smidth, F. L., & Co.
Wilfley, A. R., & Sons, Inc.

Pump, Slurry, Valves
Fuller Co., The
Wilfley, A. R., & Sons, Inc.

Pumps (Vacuum)
Allis-Chalmers Mfg. Co.
Fuller Co., The
Smidth, F. L., & Co.

Pumps (Wagon)
Gardner-Denver Co.

Pumps (Water)
Allis-Chalmers Mfg. Co.
Gardner-Denver Co.
Jaeger Machine Co.

Rails
Bethlehem Steel Co.

Railway Equipment
Easton Car & Construction Co.
General Electric Co.

Railways (Electric)
General Electric Co.

Rectifiers
Allis-Chalmers Mfg. Co.
General Electric Co.

Recuperators
Manitowoc Engineering Works
Traylor Engr. & Mfg. Co.

Refractories
Babcock & Wilcox Co.
Smidth, F. L., & Co.

Regulators (Voltage)
Allis-Chalmers Mfg. Co.
General Electric Co.

Rewashers (Screw)
Eagle Iron Works
Link-Belt Co.
Smith Engr. Wks.

Rheostats
Atlas Powder Co.
General Electric Co.
Hercules Powder Co.
Syntron Co.

Classified Directory (Cont.)

Roofing
Bethlehem Steel Co.
Ryerson, Jos. T., & Son, Inc.
Texas Co., The

Rope (Transmission)
Allis-Chalmers Mfg. Co.

Sand Drags
Eagle Iron Works
Jeffrey Mfg. Co.
Link-Belt Co.
McLanahan & Stone Corp.
Pioneer Engr. Wks.
Smith Engr. Wks.

Sand and Gravel Plants
Allis-Chalmers Mfg. Co.
Austin-Western Road Machy. Co., The
Bacon, Earle C., Inc.
Eagle Iron Wks.
Iowa Mfg. Co.
Jeffrey Mfg. Co.
Link-Belt Co.
McLanahan & Stone Corp.
Pioneer Engr. Wks.
Robins Conveying Belt Co.
Traylor Engr. & Mfg. Co.

Sand Lime Brick Machinery
Jeffrey Mfg. Co.

Sand Separators
Jeffrey Mfg. Co.
Link-Belt Co.
McLanahan & Stone Corp.
Pioneer Engineering Wks., Inc.
Smith Engineering Wks.

Sand Settling Tanks
Chicago Bridge & Iron Co.
Eagle Iron Wks.
Hendrick Mfg. Co.
Iowa Mfg. Co.
Jeffrey Mfg. Co.
Link-Belt Co.
Nordberg Mfg. Co.
Pioneer Engr. Wks.
Smith Engr. Wks.

Scales
Merrick Scale Mfg. Co.

Scales (Hopper)
Blaw-Knox Co.
Merrick Scale Co.

Scrapers (Power Drag)
American Hoist & Derrick Co.
Austin-Western Rd. Machy. Co.
Blaw-Knox Co.
Bucyrus-Erie Co.
Hayward Co., The
Iowa Mfg. Co.
Jeffrey Mfg. Co.
Link-Belt Co.
Northwest Engineering Co.
Pioneer Engr. Wks.
Sauerman Bros.

Scrapers (Wagon)
Bucyrus-Erie Co.

Screen Cloth & Plates (Perforated)
Allis-Chalmers Mfg. Co.
Bacon, Earle C., Inc.
Chicago Perforating Co.
Harrington & King Perforating Co.
Hendrick Mfg. Co.
Jeffrey Mfg. Co.
Link-Belt Co.
Pioneer Engr. Wks.
Robins Conveying Belt Co.
Ryerson, Jos. T., & Sons, Inc.
Traylor Engr. & Mfg. Co.
Tyler, W. S., Co.

Screen Parts
Allis-Chalmers Mfg. Co.
Bacon, Earle C., Inc.
Hendrick Mfg. Co.
Pioneer Engr. Wks.
Screen Equipment Co.
Traylor Engr. & Mfg. Co.

Screens
Allis-Chalmers Mfg. Co.
Austin-Western Rd. Machy. Co.
Bacon, Earle C., Inc.
Chicago Perforating Co.
Cleveland Wire Cloth & Mfg. Co.
Deister Machine Co.
Eagle Iron Works
Hendrick Mfg. Co.
Jeffrey Mfg. Co.
Lewistown Fdry. & Mach. Co.
Link-Belt Co.
McLanahan & Stone Corp.
Nordberg Mfg. Co.
Pioneer Engr. Wks.
Robins Conveying Belt Co.
Roebling's, John A., Sons Co.
Smith Engr. Wks.
Traylor Engr. & Mfg. Co.
Tyler, W. S., & Co.
Universal Vibrating Screen Co.
Williams Patent Crusher & Pulv. Co.

Screens (Grizzly)
Allis-Chalmers Mfg. Co.
Austin-Western Rd. Machy. Co.
Eagle Iron Wks.
Gay, Rubert M. Div.
Hendrick Mfg. Co.
Iowa Mfg. Co.
Jeffrey Mfg. Co.
Lewistown Fdy. & Mach. Co.
Link-Belt Co.
Pioneer Engr. Wks. Inc.
Productive Equipment Corp.
Robins Conveying Belt Co.
Roebling's, John A., Sons Co.
Ross Screen & Feeder Co.
Screen Equipment Co.
Smith Engr. Wks.
Traylor Engr. & Mfg. Co.
Tyler, W. S., Co.
Universal Rd. Machinery Co.
Universal Vibrating Screen Co.

Screens (Laboratory)
Allis-Chalmers Mfg. Co.
Hendrick Mfg. Co.
Jeffrey Mfg. Co.
Link-Belt Co.
Roebling's, John A., Sons, Co.
Smidth, F. L., & Co.
Tyler, W. S., Co.
Williams Patent Crusher & Pulv. Co.

Screens (Revolving)
Allis-Chalmers Mfg. Co.
Austin-Western Rd. Machy. Co.
Bacon, Earle C., Inc.
Eagle Iron Wks.
Gay, Rubert W. Div.
Hendrick Mfg.
Iowa Mfg. Co.
Jeffrey Mfg. Co.
Link-Belt Co.
McLanahan & Stone Corp.
Pioneer Engr. Wks.
Robins Conveying Belt
Roebling's Engr. Wks.
Smith Engr. Wks.
Traylor Engr. & Mfg. Co.
Tyler, W. S., Co.
Universal Rd. Machinery Co.

Screens (Rotary)
Link-Belt Co.
Smith Engr. Wks.

Screens (Scalping)
Allis-Chalmers Mfg. Co.
Link-Belt Co.
McLanahan & Stone Corp.
Robins Conveying Belt Co.
Screen Equipment Co.
Smith Engr. Wks.
Williams Patent Crusher & Pulv. Co.

Screens (Trommel)
Link-Belt Co.
Traylor Engr. & Mfg. Co.

Screens (Vibrating)
Allis-Chalmers Mfg. Co.
Austin-Western Road Machinery Co.
Bacon, Earle C., Inc.
Deister Machine Co.
Eagle Iron Wks.
Hendrick Mfg. Co.
Iowa Mfg. Co.
Jeffrey Mfg. Co.
Lewistown Fdry. & Mach. Co.
Link-Belt Co.
McLanahan & Stone Corp.
Nordberg Mfg. Co.
Pioneer Engr. Wks., Inc.
Robins Conveying Belt Co.
Roebling's John A., Sons Co.
Screen Equipment Co.
Smith Engr. Wks.
Tyler, W. S., Co.
Universal Vibrating Screen Co.
Williams Patent Crusher & Pulv. Co.

Screens (Washing)
Link-Belt Co.
McLanahan & Stone Corp.
Screen Equipment Co.

Scrubbers (Washers)
Link-Belt Co.
McLanahan & Stone Corp.
Smith Engr. Wks.
Tyler, W. C., Co.

Seal Rings
Traylor Engr. & Mfg. Co.

Semi-Trailers, Quarry (Side & End Dumping)
Easton Car & Construction Co.

Septic Tank Molds (Concrete)
Suburban Sanitation Systems Co.

Shafting
Allis-Chalmers Mfg. Co.
Bacon, Earle C., Inc.
Jeffrey Mfg. Co.
Link-Belt Co.
Manitowoc Engineering Works

Classified Directory (Cont.)

Shale Planers
Eagle Iron Works

Sheaves
Allis-Chalmers Mfg. Co.
Eagle Iron Wks.
Hetherington & Berner
Jeffrey Mfg. Co.
Link-Belt Co.
McLanahan & Stone Corp.
Pioneer Engr. Wks.
Roebling's, John A., Sons Co.
Sauerman Bros.

Shovels (Compressed Air)
Nordberg Mfg. Co.

Shovels, Power (Diesel, Diesel-Air Electric, Gasoline, Gas-Electric, Oil, Steam)
American Hoist & Derrick Co.
Austin-Western Rd. Machinery Co.
Bucyrus-Erie Co.
Koehring Co.
Industrial Brownhoist Corp.
Lima Locomotive Works, Inc. (Shovel & Crane Div.)
Link-Belt Speeder Corp.
Manitowoc Engineering Works
Marion Steam Shovel Co.
Northwest Engineering Co.
Thew Shovel Co.

Shovels (Tractor)
Austin-Western Rd. Machy. Co.
Koehring Co.
Lima Locomotive Works, Inc. (Shovel & Crane Div.)
Link-Belt Speeder Corp.

Shovels (Truck)
Link-Belt Speeder Corp.
Thew Shovel Co.

Shovels (Underground)
Allis-Chalmers Mfg. Co.
Lima Loco. Wks., Inc. (Shovel & Crane Div.)
Nordberg Mfg. Co.
Thew Shovel Co.

Shredders
Williams Patent Crusher & Pulv. Co.

Sieves (Testing)
Hendrick Mfg. Co.
Roebling's, John A., Sons Co.
Smidth, F. L., & Co.
Tyler, W. S.

Silos (Storage)
Blaw-Knox Co.
Chicago Bridge & Iron Co.
Marietta Concrete Corp.
Smidth, F. L., & Co.

Silo Stave Machines (Concrete)
Besser Mfg. Co.

Skids
Besser Mfg. Co.
Chase Foundry & Mfg. Co.
Easton Car & Construction Co.

Slakers (Rotary)
Traylor Engr. & Mfg. Co.

Slugs (Grinding)
Smidth, F. L., & Co.

Slurry Mixers
Manitowoc Engineering Works
Smidth, F. L., & Co.

Slurry Separators
Smidth, F. L., & Co.

Slurry Thickeners
Manitowoc Engineering Works
Smidth, F. L., & Co.
Traylor Engr. & Mfg. Co.

Smokestacks
Chicago Bridge & Iron Co.
Hendrick Mfg. Co.
Manitowoc Engineering Works
Northern Blower Corp.
Traylor Engr. & Mfg. Co.

Speed Reducers (Gear, etc.)
Allis-Chalmers Mfg. Co.
Bacon, Earle C., Inc.
Iowa Mfg. Co.
Jeffrey Mfg. Co.
Link-Belt Co.
Northern Blower Co.
Smidth, F. L., Co.
Traylor Engr. & Mfg. Co.

Spouts
Jeffrey Mfg. Co.
Link-Belt Co.
Traylor Engr. & Mfg. Co.

Sprays & Spraying Equipment
Link-Belt Co.

Sprockets
Allis-Chalmers Mfg. Co.
Bacon, Earle C., Inc.
Iowa Mfg. Co.
Jeffrey Mfg. Co.
Link-Belt Co.
McLanahan & Stone Corp.

Stabilization Equipment
Barber-Greene Co.
Besser Mfg. Co.
Pioneer Engr. Wks.

Standpipes
Chicago Bridge & Iron Co.
Ross Screen & Feeder Co.

Steel (Abrasive-Resisting)
Ryerson, Jos. T., & Son, Inc.

Steel (Electric Furnace)
Timken Roller Bearing Co., The

Steel (Open Hearth)
Timken Roller Bearing Co., The

Steel (Special Alloy)
Chicago Steel Foundry Co.
Timken Roller Bearing Co., The

Stokers
Babcock & Wilcox Co.
Combustion Engr. Co., Inc.
Link-Belt Co.

Storage Equipment
Barber-Greene Co.
Blaw-Knox Co.
Chicago Bridge & Iron Co.
Jeffrey Mfg. Co.
Kern, Fred T., Co.
Link-Belt Co.
Robins Conveying Belt Co.
Sauerman Bros., Inc.

Strippers (Concrete)
Anchor Concrete Machinery Co.
Multiplex Concrete Machinery Co.

Switchboards
Allis-Chalmers Mfg. Co.
General Electric Co.

Tachometers
General Electric Co.

Tampers (Power & Hand)
Anchor Concrete Machinery Co.
Besser Mfg. Co.
Kent Machine Co.
Multiplex Concrete Machinery Co.
Stearns Mfg. Co.
Syntron Co.

Tanks (Air, Storage, etc.)
Allis-Chalmers Mfg. Co.
Blaw-Knox Co.
Chicago Bridge & Iron Co.
Combustion Engr. Co.
Eagle Iron Wks.
Heltzel Steel Form & Iron Co.
Hendrick Mfg. Co.
Jeffrey Mfg. Co.
Link-Belt Co.
Northern Blower Co.
Pioneer Engr. Wks.
Raymond Pulv. Div.
Traylor Engr. & Mfg. Co.

Testing Instruments
General Electric Co.

Towers
Blaw-Knox Co.
Eagle Iron Works
Hendrick Mfg. Co.
Jaeger Machine Co.
Robins Conveying Belt Co.
Sauerman Bros., Inc.

Track and Track Equipment
Besser Mfg. Co.
Chase Foundry & Mfg. Co.
Nordberg Mfg. Co.

Track Shifters
Nordberg Mfg. Co.

Track Systems (Overhead)
Jeffrey Mfg. Co.
Link-Belt Co.

Tractors
Allis-Chalmers Mfg. Co.
Caterpillar Tractor Co.
Koehring Co.

Tractors (Electric)
Link-Belt Co.

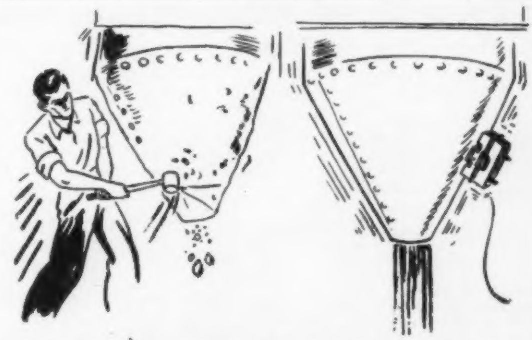
Trailers (Industrial, Quarry)
Allis-Chalmers Mfg. Co.
Austin-Western Rd. Machinery Co.
Easton Car & Construction Co.
Ford Motor Co.
Iowa Mfg. Co.
Koehring Co.
Link-Belt Speeder Corp.

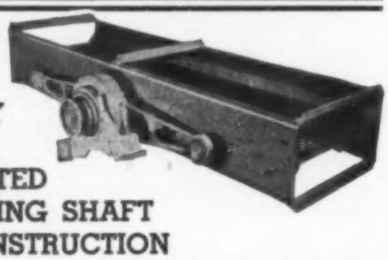
Transformers
Allis-Chalmers Mfg. Co.
General Electric Co.

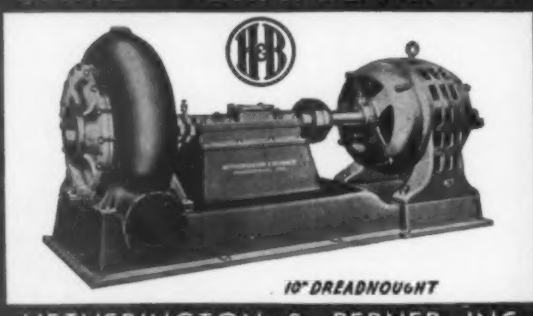
Trench Hoes
Link-Belt Speeder Corp.

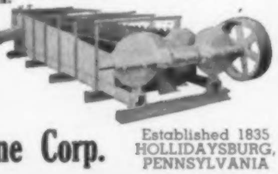
Trucks (Agitator)
Blaw-Knox Co.
Jaeger Machine Co.
Smidth, F. L., & Co.

Truck Bodies (Dump)
Commercial Shearing & Stamping Co.
Dempster Bros.
Easton Car & Construction Co.
Ford Motor Co.
Hendrick Mfg. Co.









Classified Directory (Cont.)

Trucks (Dump)
Chase Foundry & Mfg. Co.
Ford Motor Co.

Trucks (Electric)
Easton Car & Construction Co.

Trucks (Gas-Electric)
Easton Car & Construction Co.

Trucks (Hand)
Chase Foundry & Mfg. Co.

Trucks (Industrial)
Chase Foundry & Mfg. Co.
Easton Car & Construction Co.
Iowa Mfg. Co.

Trucks (Mixer)
Blaw-Knox Co.
Jaeger Machine Co.
Smidth, F. L., & Co.

Tubing (Seamless Steel)
Timken Roller Bearing Co.

Turbines
Allis-Chalmers Mfg. Co.
General Elec. Co.

Turntables (Industrial)
Easton Car & Construction Co.

Unloaders (Car, Bin, Truck, etc.)
Barber-Greene Co.
Bucyrus-Erie Co.
Fuller Co.
Gay, Rubert M. Div.
Jeffrey Mfg. Co.
Link-Belt Co.
Marion Steam Shovel Co.
Northwest Engineering Co.
Robins Conveying Belt Co.
Universal Road Machinery Co.

Unloaders (Boat)
Link-Belt Co.

Unloaders (Box Car)
Barber-Greene Co.
Besser Mfg. Co.
Fuller Co.
Gay, Rubert M. Div.
Jeffrey Mfg. Co.
Link-Belt Co.
Stearns Mfg. Co.
Universal Rd. Machinery Co.

Unloaders (Pneumatic)
Fuller Co.

Unloaders (Underground)
Jeffrey Mfg. Co.
Nordberg Mfg. Co.

Ventilating Apparatus
Blaw-Knox Co.
Northern Blower Co.

Vibrators (Bin and Concrete Form)
Besser Mfg. Co.
Jeffrey Mfg. Co.
Link-Belt Co.
Stearns Mfg. Co.
Syntron Co.
Tyler, W. S.

Vibrating Screens
Allis-Chalmers
Austin-Western Rd. Machinery Co., The
Bacon, Earle C., Inc.
Deister Machine Co.
Eagle Iron Works
Gay, Rubert W. Div.
Hendrick Mfg. Co.
Iowa Mfg. Co.
Jeffrey Mfg. Co.
Link-Belt Co.
McLanahan & Stone Co.
Nordberg Mfg. Co.
Pioneer Enginering Wks.
Robins Conveying Belt Co.
Screen Equipment Co.
Smith Engr. Wks.
Tyler, W. S., Co.
Universal Vibrating Screen Co.
Williams Patent Crusher & Pulv. Co.

Wagons (Dump)
Allis-Chalmers Mfg. Co.
Austin-Western Rd. Machy. Co.
Blaw-Knox Co.
Easton Car & Construction Co.
Koehring Co.

Washers (Log)
Allis-Chalmers Mfg. Co.
Eagle Iron Works
Jeffrey Mfg. Co.
Link-Belt Co.
McLanahan & Stone Corp.
Pioneer Engr. Wks., Inc.
Smith Engr. Wks.
Traylor Engr. & Mfg. Co.

Washers (Sand, Gravel & Stone)
Allis-Chalmers Mfg. Co.
Austin-Western Rd. Machy. Co.
Bacon, Earle C., Inc.
Chicago Bridge & Iron Co.
Gay, Rubert M. Div.
Hendrick Mfg.
Iowa Mfg. Co.
Jeffrey Mfg. Co.
Lewiston Fdry. & Machy. Co.
Link-Belt Co.
McLanahan & Stone Corp.
Robins Conveying Belt Co.
Roebling's, John A., Sons Co.
Smidth, F. L., & Co.
Smith Engr. Wks.
Traylor Engr. & Mfg. Co.
Tyler, W. S., Co.
Universal Road Machy. Co.
Universal Vibrating Screen Co.

Weighing Equipment
Blaw-Knox Co.
Fuller Co.
Heltzel Steel Form & Iron Co.
Jaeger Machine Co.
Merrick Scale Co.
Schaffer Poidometer Co.

Welding and Cutting Equipment
General Electric Co.
Roebling's, John A., Sons Co.

Welding Rods
Roebling's, John A., Sons Co.
Ryerson, Jos. T., & Son, Inc.

Welding Wire
Hazard Wire Rope Div.
Roebling's, John A., Sons Co.

Winches
American Hoist & Derrick Co.
Jeffrey Mfg. Co.
Link-Belt Co.
Robins Conveying Belt Co.

Wire Cloth
Bacon, Earle C., Inc.
Cleveland Wire Cloth & Mfg. Co.
Eagle Iron Works
Leschen, A., & Sons Rope Co.
Link-Belt Co.
Ludlow-Saylor Wire Co.
Pioneer Eng. Wks., Inc.
Robins Conveying Belt Co.
Roebling's, John A., Sons Co.
Screen Equipment Co.
Tyler, W. S., Co.
Universal Vibrating Screen Co.

Wire (Copper, Iron & Steel)
General Electric Co.
Roebling's, John A., Sons Co.

Wire (Electric)
General Electric Co
Roebling's, John A., Sons Co.

Wire Rope
American Cable Co.
Bethlehem Steel Co.
Hazard Wire Rope Co.
Leschen A., & Sons, Rope Co.
Roebling's, John A., Sons Co.

Wire Rope Clips
American Cable Co.
American Hoist & Derrick Co.
Bethlehem Steel Co.
Hazard Wire Rope Co.
Leschen A., & Sons
Laughlin, Thomas, Inc.
Roebling's, John A., Sons Co.

Wire Rope Fittings
American Cable Co.
American Hoist & Derrick Co.
Bethlehem Steel Co.
Hazard Wire Rope Co.
Leschen A. & Sons, Rope Co.
Laughlin, Thomas, Inc.
Roebling's, John A., Sons Co.

Wire Rope Hooks
American Cable Co.
American Hoist & Derrick Co.
Hazard Wire Rope Co.
Laughlin, Thomas, Inc.
Leschen A., & Sons, Rope Co.
Roebling's, John A., Sons Co.

Wire Rope Lubricants
Roebling's, John A., Sons Co.
Texas Co., The

Wire Rope Slings
American Cable Co.
Bethlehem Steel Co.
Hazard Wire Rope Co.
Leschen, A., & Sons, Rope Co.
Roebling's, John A., Sons

Wire Rope Sockets
American Cable Co.
American Hoist & Derrick Co.
Hazard Wire Rope Co.
Laughlin, Thomas, Inc.
Leschen, A., & Sons Rope Co.
Roeblings, John A., Sons Co.

Wire Rope Thimbles
Laughlin, Thomas, Inc.

Wire Turnbuckles
Laughlin, Thomas, Inc.

Classified Advertisements

CLASSIFIED RATES

POSITIONS WANTED — POSITIONS VACANT Set in six-point type. Minimum $1.00 each insertion, payable in advance.

INFORMATION—Box numbers in care of our office. An advertising inch is measured vertically in one column. Three columns, 30 inches to the page.

CLASSIFIED—Displayed or undisplayed. Rate per column inch, $5.00. Unless on contract basis, advertisements must be paid for in advance of insertion.

Consolidated Offers:

PULVERIZERS

2—4 roll Raymond High Side Mills, also 3-roll.
3—5 and 6-roll Raymond Low Side Mills.
8—Raymond beater types, Nos. 0000, 00, 1, 3 and Nos. 32, 55, 60 and 90 Imp. Mills.
1—24" No. 4 Mikro Pulverizer.
4—Sturtevant Ring Roll Mills, Nos. 0, 1, 2.
Coal Pulverizers—Raymond, Aero, Erie City, Simplex, Kennedy.
Kent Maxecon and Bradley Mills.

JAW CRUSHERS

42"x48" Traylor; 15x30, 18x36, 24x36, 30x42" Farrel; 24"x36", 36x48 Allis-Chalmers; 30x42 Buchanan.

REDUCTION GYRATORY CRUSHERS

3' Traylor; 4' Traylor No. 410-TZ; 5" Newhouse with 40 H.P. motor; Nos. 19, 25, 37, 49 Kennedy.

VIBRATING SCREENS

5—5'x10' Symons Screens, 2-deck, each with 7½ H.P. 3/60/440 volt motor.
5—4'x7' Jeffrey-Traylor FB-4, magnetic, all 2-deck. Used 30 days. With motor generator sets, panels, etc.
2—4'x8' Robins Gyrex, 2-deck.
2—3'x6' Sturtevant Moto-Vibro, 2-deck.
8—Tyler Hummers, 3'x5', 4x5, 4x7, 1 to 3 decks.

LOCOMOTIVE

16-ton Whitcomb Gasoline Locomotive, standard gauge, 6-cylinder, 6x7 motor, self-starter. 90% new. Running demonstration.

LOCOMOTIVE CRANE

25-ton capacity Ohio, 8 wheel, standard gauge, ASME boiler, double drum, 50 ft. boom.

AIR COMPRESSORS

2—No. 315 and No. 370 I.R. Portable—Oil Engine driven.
2—POC, I.R., 506 CFM., Diesel driven.
2—POC-2 I.R., 550 CFM., Diesel driven.
1—PRE-2 I.R., 1300 CFM., syn. motor.
2—WN-31 Sullivan, 1573 CFM., syn motors.

BINS AND TANKS

12—10'x30' Vertical Steel Tanks, 125 tons or 18,000 gallons, at Peekskill, N. Y.
1—Blaw Knox 300 bbl. Cement Bin, electric scales, generator sets. Complete.

ROTARY DRYERS

9—3'x20, 4x30, 5x30, 6x40, 6x60, 8x60, 8'8"x85'.
2—5x30', 70"x35' Ruggles-Coles, double shell.
1—5x35' Indirect Heat, double shell.

ROTARY KILNS

3—6'x40' Bonnot, each complete with firing hood, spring seals and with or without rotary coolers; also 4'x30' Ruggles-Coles; 5x50' Vulcan; 5'4x33' Fuller; 6x60' Reeves; 7x100' Vulcan; 8x110' Reeves.

AIR CLASSIFIERS

4—10' Sturtevant "Whirlwind".
4—8', 10', 12', 14' Gayco.
1—30" Raymond.

BALL, ROD AND TUBE MILLS

2—6'x12' Hardinge Rod Mills—direct drive.
2—6'x12' Allis-Chalmers Rod Mills, inc. motors.
1—3'x12' Hendy Tube Mill.
1—5'x36' Vulcan, 3-comp. iron lined, used 3 days.
6—Hardinge Conical Mills—4'6"x16", 5'x22", 6'x22", 8'x30".
1—6'x8' Patterson cont. Mill with air separator.
8—Pebble Mills: 4'6"x3'6", 5x4, 6x8, 7'6x5' and other sizes.
4—5'x22', 6x22, Tube Mills—iron and silex lined.
1—5'x10' Marcy Rod Mill.

Write for detailed illustrated circulars.

CONSOLIDATED PRODUCTS CO., INC.
15-16-17 PARK ROW **NEW YORK, N. Y.**

Our shops at Newark, N. J., cover eight acres.

CRUSHERS

GYRATORY: 42" McCully with 90% brand new parts. 36" Allis-C. 20" Super. McCully conv. to 16". Gates Nos. 10, 9, 8, 7½, 6, 5, 4, 3, 2, 1 (75 avail.) Telsmith Nos. 4, 5, 6, 8C, 9 & 16. Also Many Austins, Kennedys and Traylors, many sizes.
JAW TYPE: Traylor 60x84, 48x60, 42x48, 24x72, Superior 84x66 & 24x36. Buchanan 30x42. Farrel 60x42, 30x36, 24x36, 18x36, 12x24. Good Roads 1030. Acme 24x40. Misc. 7x12, 9x16, 8x20, 8x24, 12x24, 9x36, 9x30, 15x36.
REDUC. TYPE: Kennedy Nos. 25, 37 & 49. Telsmith 3-F & 40. Traylor 36" TZ, 8", 10", 12" Super. McCully 6" & 10". Newhouse 5, 7 & 10". Symons Cone & Disc Ty. 2' to 4'.
ROLLS: Allis-C. 12½x12, 36x16, 40x15, 54x24 & 72x30. Fairmount 36x60 & Jeffrey 24x24 to 36x54 single roll. Cornish 36x14 & 42x16, Etc., Etc.
HAMMERMILLS: Williams No. 1, 2, 3, 4, 8 & 9. Jeffrey 36x18 & 36x42. Day Nos. 20 & 40, Etc.
MILLS: Kennedy Ball 4x6, 5x6 & 5x8. Marcy 8x6 & 10x9. Hardinge 6'x3', 8'x30" & 6'x9'. Misc. Tube Mills 5' & 6' x 22'. Sturtevant Ring Roll, Raymonds, Kents, Fuller-Lehigh, Etc., Etc.
CRUSHING PLANTS: No. 65 Diamond. No. 22 Pioneer 8x24. 1030 Good Roads, 9x40 Austin-Western, 9x36 C.R.

MISCELLANEOUS ITEMS

Barges, Bins, Buckets, Boilers, Cableways, Cars, Compressors, Conveyors, Cranes, Dryers, Derricks, Draglines, Drag Scrapers, Dredges, Drills, Engines, Elevators, Excavators, Generators, Hoists, Kilns, Locomotives, Loaders, Motors, Pipe, Pumps, Rail, Scales, Screens, Slacklines, Shovels, Tanks, Trucks, Tractors, Etc., in many sizes, types and makes at low prices. **(I have equipment at many points in the United States and Canada. What you need may be near your plant.)**

ALEXANDER T. McLEOD
7229 Rogers Avenue CHICAGO

SEND US YOUR INQUIRIES

150 HP Scotch Marine Type **Boiler**. Retubed.
⅝ yd. **Northwest** No. 3 Gas Shovel & Dragline. Rebuilt.
48 HP **Cummins** 80, 100, 120 HP **Fairbanks Diesels**.
2 Buda 80/150 HP Power Units, Oil-Gas-Gasoline.
14x8x14" Ingersoll Rand Compressor & 100 HP motor.
2 and 3 Drum **Hoists**. Steam-Electric-Gasoline.
3—333 KVA **Transformers**. 1/60/2300 to 110/220 v.
All Sizes—Crushers—Shovels—Cranes—Compressors.

MISSISSIPPI VALLEY EQUIPMENT CO.
515 LOCUST ST. ST. LOUIS, MO.

DIESEL OIL ENGINES

One 600 ft. Sullivan Air compressor Direct connected. 150 Hp. Full Diesel Oil Engines. Low price and terms. Diesel Oil Engines-Contractors Eqpt.

J. D. ANDERSON MCHY. CO.
5516 Maple Ave. St. Louis, Mo.

RAILS—1 Ton or 1000

NEW RAILS—5000 tons—All Sections—All Sizes.
RELAYING RAILS—25,000 tons—All Sections—All Sizes, practically as good as New.
ACCESSORIES—New—Every Track Accessory carried in stock—Angle and Splice Bars, Bolts, Nuts, Frogs, Switches, Tie Plates.
Buy from One Source—Save Time and Money.
'Phone, Write or Wire

L. B. FOSTER COMPANY, Inc.
PITTSBURGH NEW YORK CHICAGO

ROTARY DRYER

4'-0" dia. x 30'-0" long Rotary Dryer, practically new, reasonably priced.

McDERMOTT BROS. CO.
Allentown, Pennsylvania

FOR SALE

Simplicity Vibrating Screen, 3' x 6', 3 deck, dust tight enclosure. V-Belt Drive, 3 HP motor.

GEORGE M. MERIWETHER
806 Farley Building Birmingham, Alabama

DIESEL GENERATOR PLANT

SIX 360 HORSE-POWER UNITS

2160 HORSE-POWER

Individual Units Can Be Purchased.
Immediately Available for Re-Installation and Service.
Inspection in Operation. Full Information on Request.

A. G. Schoonmaker Corporation
38 Hudson St. Phone Bergen 4-5300 Jersey City, N. J.

HYDRATORS
3 Kityer & Schultless Hydrators.

AIR COMPRESSORS
BELTED: 255, 528, 676, 1000, 1300 & 1570 Ft.
ELECTRIC: 478, 676, 807, 1302, 1722 & 2200 Ft.
DIESEL: 603, 807 & 1000 Ft.
PORTABLE GAS: 110, 160, 220, 310, 540 & 1300 Ft.
STEAM: 49, 310, 528, 1300, 2200 & 3600 Ft.

CLAMSHELL BUCKETS, SKIPS AND GRAPPLES
Owen R A & H Stone Grapples.
2 Yd. OWEN Type S Material Handling.
1½ Yd., 1 Yd. & ¾ Yd. HAYWARD Class E.
48 Steel Skips 6½ x 6 x 2½.
5 Ton Bucyrus Rack Grabs.

CRANES AND DRAGLINES
¾ Yd. 5 Ton O & S 30 Ft. Boom.
12 Ton NORTHWEST 50 Ft. Boom Gas.
25 Ton BROWNING & 30 Ton AMERICAN Loco.
25 Ton LINK BELT K-48 Electric, 70 Ft. Boom.

CATERPILLAR SHOVELS
¾ Yd. Bucyrus 10B Electric & ¾ yd. Nisley Gas.
2 Yd. Marion Steam Shovel.
¾ Yd., 1½ Yd., 2 Yd. & 4 Yd. MARION Electrics.
1 Yd. NORTHWEST Gas.
1½ Yd. BUCYRUS 41B Steamer.
4 Yd. Bucyrus 120B Electric. Also 2 yd. Erie Elec.

DUMP CARS
46—KOPPEL 1½ Yd. 24 & 30 In. Ga., V Shaped.
15—2 Yd., 3 Yd., 4 Yd., 6 Yd., 12 Yd., 36 In. Ga.
30—Std. Ga. 12 Yd., 16 Yd., 20 Yd. & 30 Yd. Cap.
15—Std. Ga. 50 Ton Battleship Gondolas.

FLAT CARS
9—50 ton std. ga. heavy duty flat cars.

HOISTING ENGINES
Gas: 15, 30, 60, 100 & 120 HP.
Electric: 30, 52, 80, 100 & 150 HP.
Steam: 6¼x8, 7x10, 8¼x10, 10x12, 12x14.

DIESEL UNITS
75, 90, 180, 240 HP F. M. Engines.
110 HP Ingersoll Rand Engine.
175 KVA Worthington 3/60/2300.
275 KVA Fairbanks 3/60/2300.

BALL, ROD AND TUBE MILLS
6 x 8 Pebble Mill & 5 x 5 Batch Mill.
8' x 8" & 5' x 22" HARDINGE CON. Dry Ball Mill.
9' x 36" HARDINGE CONICAL Wet Ball Mill.
6' x 22" HARDINGE CONICAL Pebble Mill.
8' x 22" HARDINGE CONICAL Ball or Pebble Mill.
4x8, 8x6 & 10x9 Straight Ball Mills.
4x16, 5x18 & 5x22 Tube Mills & 6'x22'.
3½x8 & 5x7 Air Swept Tube Mills.
2x4½, 3x10 & 5x12 ROD MILLS.

PULVERIZERS
JEFFERY 24 x 20 & 1½ Sturtevant R.R.
RAYMOND Auto. Pulverizer No. 0000, 0 & 3.
RAYMOND Imp Mills No. 4, 32 & 55.
GRUENDLER XXB Mill & Jay Bee No. 3 & 4.
RAYMOND 4 & 5 ROLL MILLS & 5 ft. Chaser M.

STEEL STORAGE TANKS
10,000 Gal., 15,000 Gal. & 20,000 Gal. Cap.

MATERIAL BIN
116 Ton Blaw Knox 2 Compt.

400 BARREL CEMENT BIN
400 Barrel Butler Portable Steel Cement Bin with Fuller automatic batcher, push button control.

SEPARATORS AND COLLECTORS
Gayco 5 ft., 12 ft. and 14 ft. Separators
Type 800 Sly 8x24, 8x32 and 16x42 Dust Collectors.

ROLL CRUSHERS
36x60 Fairmount & 36x16 Allis Chalmers.

JAW CRUSHERS
10x8, 12x7½, 14x7, 15x9, 15x10, 16x9, 16x12, 16x10, 18x11, 20x8, 20x6, 20x10, 20x12, 26x12, 30x15, 30x13, 36x15, 36x30, 36x18, 36x14, 36x9, 36x6, 36x10, 36x24, 42x9, 48x42, 48x36, 60x42, 84x66, 36x16, 9x36.

CONE & GYRATORY CRUSHERS
42 in. McCully Mammoth Gyratory.
5 No. 19, 25, 37 & 49 Kennedy.
18 in., 24 in., 30 in., 36 in. and 48 in. Symons Disc.
4—10 TZ Traylor 4 ft. Gyratory.
4—Nos. 5 3 & 6 Austin Gyratory.
2—Traylor T-12 Bulldog Gyratory, also 16 inch.
8 in. Traylor T. Gyratory.
17 Gates K—Nos. 3, 4, 5, 6, 7½, 8 & 9½.
10 Inch Austin Model 105.
10 & 12 Inch Superior McCullys.

BUCKET ELEVATORS
7 Steel Encased Chain & Belt Elevators:
15 In. by 60 Ft., 24 In. by 63 Ft., 18 In. by 48 Ft., 12 In. by 30 Ft.
ELEVATOR BELT: 600 Ft., 30 In.—1326 Ft. 20 In. & 18 In., 328 Ft. 16 In., 260 Ft. 14 In.

CONVEYOR PARTS
BELT: 1000 Ft. 60 In., 700 Ft. 40 In., 600 Ft. 36 In., 800 Ft. 30 In., 1642 Ft. 24 In., 517 Ft. 20 In., 297 Ft. 18 In., 500 Ft. 16 In., 200 Ft. 14 In.
IDLERS: 54 In., 42 In., 36 In., 30 In., 24 In., 20 In., 18 In., 16 In. & 14 In.
Head & Tail—Pulleys—Takeup for all sizes.
Steel Frames: 2,000 Ft. 24 In., 30 In. & 36 In. Sections.

ROTARY DRYERS AND KILNS
96 In. x 20 Ft., 3 Ft. x 30 Ft., 4 Ft. x 30 Ft., 54 In. x 30 Ft., 42 In. x 24 Ft., 5 Ft. x 30 Ft., 5 Ft. x 16 Ft., 5 Ft. x 60 Ft., 6 Ft. x 60 Ft., 6 Ft. x 20 Ft., 6 Ft. x 70 Ft.

RUBBER HOSE
Air ¾ to 1½ in., Water ¾ to 10 in.

STEEL DERRICKS
GUY: 8 Ton 85 Ft. Boom, 15 Ton 100 Ft. Boom. 20 Ton 115 Ft. Boom, 50 Ton 100 Ft. Boom.
STIFF LEG: 5 Ton 70 Ft. Boom, 15 Ton 100 Ft. Boom, 25 Ton 100 Ft. Boom, 75 Ton 135 Ft. Boom.

LOCOMOTIVES
GASOLINE: 3 Ton, 5 Ton, 8 Ton, 12, 14, and 30 Ton.
STEAM: 9 Ton, 20 Ton, 40 Ton, 60 Ton & 80 Ton.
ELECTRIC: 2 Ton, 5 Ton, 8 Ton, 40 Ton.

SCREENS
VIBRATING: 2x4, 3x6, 12x8, 3x8, 3x5, 4x5, 4x8, 4x10, 48x72 & 4x12, 1, 2 & 3 Deck.
HUMMER, ROTEX, NIAGARA & ROBINS.
REVOLVING: 3x12, 3x16, 3½x18, 3x24, 4x16, 4x20, 4x22, 4x24, 5x30, 5x20, 6x20.

COMPLETE PLANTS BOUGHT AND SOLD

R. C. STANHOPE, INC.
(Cable Address: "STANEQUIP" New York)
875 Sixth Avenue, New York, N. Y.

BINS: Bulk Cement Bin, 223 Bbl. capacity; also one 85 ton, 2 compartment Material Bin, all steel.

BULK CEMENT UNLOADER: Fuller Kinyon, portable, self-propelled, with built-in motor, 40 H.P.—A.C., complete.

BUCKETS: Blaw Knox 2 yd. and 3 yd. capacity Clam Shell; one Hayward 3 yd. capacity Orange Peel.

CARS: Six Clark 20 yd. capacity, standard gauge, all steel, 2-way air dump cars, apron type doors; Six Kopple 12 yd., all steel, standard gauge, hand dump cars; ten 50 ton, all steel, hopper bottom gondola cars.

BOILERS: 100 H.P. Farquhar, locomotive type, on skids, National Board, 125 lbs. pressure; also one 40 H.P. Locomotive type, 190 lbs. pressure.

COMPRESSORS: One Ingersoll-Rand 320 cu. ft. portable, gas, on steel wheels.

CRUSHER SPECIALS: Two 24 x 36; one 13 x 30, Jaw Crushers. One Kennedy 25 Reduction Crusher, with 50 H.P. vertical motor, V-belt drive. One Allis-Chalmers 12"; and one 30" Superior McCully Gyratory crushers.

CRUSHER ROLLS: Two 16 x 36; one 16 x 42; one 24 x 54.

BELT CONVEYOR: One 36" x 200'.

DIESEL ENGINE: One 450 H.P. Cooper-Bessemer, 4 cylinder, 4 cycle, solid injection, 225 R.P.M., with or without 300 K.W.—A.C. Generator, 2300 volt, complete with all auxiliary equipment.

DREDGE PUMPS: One Morris 6" with 5 H.P., A.C. 220 volt, variable speed motor; also one Morris 10" Belt Drive.

DRILL SHARPENER: Ingersoll Rand size 50, with dies and dollies for hollow, round and Hex steel.

DRYER: One Ruggles Cole double shell, 8'6" x 86'.

HOIST: Sullivan double drum, 50 H.P. electric, for sluicing and drag scraper work; one National 2 drum with swinger attached, with or without 65 H.P. Buda motor.

LOCOMOTIVES: Gasoline, 14 ton Whitcomb, 36" gauge; also one 25 ton Vulcan, standard gauge.

KILNS: Two 7'6" x 100' and two 6' x 100'.

MAGNETIC PULLEY: 24" Dia., 48" Belt.

PUMP: One Fairbanks-Morse centrifugal, direct connected to 40 H.P. A.C. motor, capacity 1200 G.P.M. at 96' head.

PULVERIZERS: One Sturtevant No. 1 Ring Roll Mill. One Raymond Five Roller High Side Mill.

SCREENS: 3 x 6; and 3 x 8, double deck Vibrator V-belt drive; one 60" x 20', revolving screen for scalping or scrubbing, with one section blind; also two 48" x 24' sizing screens, with 7' diameter outerjacket. One—Link Belt 3 x 5, single deck, heavy duty.

SLACKLINES: Sauerman, 75 H.P. electric, 90' mast, ¾ yd. bucket, cables, etc.

TRACKSHIFTER: One Nordberg Model N, 4 cylinder Hercules motor, complete with boom for loading and laying rail.

TRACK: 600 ft. of 24" gauge, portable track, with switches and fifteen 1 yd. capacity all steel cars.

A. J. O'NEILL
Lansdowne Theatre Bldg., Lansdowne, Pa.
Philadelphia 'Phone—Madison 7578

Kennedy Nos. 19 & 37 and No. 10 McCully Fine Reduction Gyratory Crushers.
1—15x36", 2—24x36 and 42x60 Farrell, 24x72" Traylor Jaw Crushers.
40x15" and 54x24" Anaconda Crushing Rolls.
16, 18, 19 & 21 ton 36" ga. Saddle Tank Locomotives.
1 yd. Koppel, 4 yd. Western, 36" ga. Dump Cars, fine.
200 HP Fulton Diesel Generator Sets 2300-220V.
2T and 3W Monighan Walker Draglines, elec. or Diesel. Bucyrus-Erie 5 yd. Diesel elec. Draglines.
Vibrating Screens, all makes and sizes.
Shovels, Cranes, Steam, Gasoline, Diesel, Draglines.
Anything and everything for quarry operation.
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ALL SECTIONS

Also contractors' equipment, "V" shaped and Western cars, 24 and 36-in. gauge, portable track, gas locos, frogs and switches. Attractive prices quoted. Wire, write or telephone for quotations.

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Backed by
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Offered Subject to Prior Sale

1—4½'x16" Hardinge Conical Ball Mill with Titanite and chrome steel lining, scoop feeder, spur gears and pulley drive, together with one 27"x6' Hardinge Counter Current Classifier; also, pulley driven, f.o.b. York, Pa.

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As there is great demand for all of this equipment, we suggest your wiring us for complete details as the equipment will be sold to those who get their orders in first.

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35 Ton McMyler eight wheel steam locomotive crane.
2-Yard 50-B Bucyrus caterpillar mounted, full revolving steam shovel. Two duplicates.
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4-Yard Monighan diesel walking dragline.
2-Yard Monighan diesel walking dragline.
5-Yard Western two way side dump cars, steel underframe, heavy duty, 36" gauge. 50 cars available.
25 Ton Porter four wheel saddle tank locomotive, 36" gauge, 12x16" cylinders, National Board boiler.
21 Ton Vulcan four wheel saddle tank locomotive, 36" gauge, 11x16" cylinders, National Board boiler.
22 Ton Plymouth gasoline locomotive, standard gauge.
8 Ton Plymouth gasoline locomotive, standard gauge.

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New Elevator Buckets of all sizes. Also Bins and Tanks, Bolted or welded.

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Truck Crane, ½ yard capacity, Orton gasoline operated.
Locomotive Crane-Orton, 7½ ton capacity. Equipped with a 50 ft. boom and gasoline operated. New 1934.
Conveyor Equipment—Head and tail pulleys for 24" and 30" belt. Ball bearing idlers for 24" belt.

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BALDWIN LOCOMOTIVE—1—40 ton saddle tank, standard gauge, (ASME).
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2—**CRUSHING ROLLS** 16 x 10", 40 x 16".
3—**JAW CRUSHERS** 4 x 8", 5 x 10", 15x20".
2—Tyler Hummer **SCREENS** 3' x 5'.

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New York 183 Varick Street New York

For Prompt Shipment Subject to Prior Sale

10 x 36 Gruendler Roller Bearing Crusher Plant with RA2P LeRoi Engine.
28' Elevator.
36 x 12' Screen.
30 Ton, 4 compartment Bin.
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NEW 15 x 36 Gruendler Roller Bearing Jaw Crusher.
NEW 11 x 20 Bronze Bearing Jaw Crusher.
NEW 24 x 36 Plain Bearing Jaw Crusher.
NEW 30 x 18 Roller Bearing Double Roll Crusher.
1—USED 5 ton per hour Day Pulverizer.
1—USED 10 to 15 ton per hour Gruendler Pulverizer.
1—NEW 10 to 15 ton per hour Pulverizer.
1—NEW 6 to 7 ton per hour Gruendler Pulverizer.
1—36 x 16' Trunnion type Revolving Screen with Dust Jacket.

CRUSHER SERVICE
Box 975 St. Louis, Missouri

FOR SALE

USED EQUIPMENT

9x18 DIAMOND Roller Bearing Jaw Crusher.
10x20 DIAMOND Roller Bearing Jaw Crusher.
10x36 DIAMOND Roller Bearing Jaw Crusher.
15x36 DIAMOND Roller Bearing Jaw Crusher.
2'0"x4'0" Single Deck DIAMOND Vibrating Screen.

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1—DIAMOND 9x16 Bronze Bearing Jaw Crusher mounted on truck with 15-20 H.P. engine. Special price for quick sale.

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LIQUIDATING GOOD AS NEW EQUIPMENT FROM PLANT GOING OUT OF BUSINESS

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CRUSHER—Jaw—14" x 24"—Manganese.
CRUSHER—Roll—14" x 24".
Acme No. 1 Limestone Pulverizer—hammer type.
Jeffrey 15" x 8" Junior Lime Pulverizer.
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1 Patterson Silex-lined 4' x 8' continuous Pebble Mill.
1 Hardinge 8' x 22" Steel Ball Mill (new lining).
Send for Complete Description and Quotations

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Motors and Generators, A.C. and D.C., for sale at attractive prices. New and Rebuilt. All fully guaranteed. Write for List and Prices.

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WANTED

1—eight yard capacity Crescent bucket in good condition, complete with hanger if possible. Advise by air mail, **Box 898, care of Rock Products, 205 West Wacker Drive, Chicago, Ill.**

WILL PAY CASH FOR GOOD:

(1) Lime Hydrating Outfit.
Rotary Kilns and Dryers.
Hammermills, Pulverizers and Rolls.
Ball, Rod and Tube Mills.
Air Compressors: Diesel, Btd., Elec. & Steam.
Crushers: Jaw—Gyratory and Cone.

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WANTED

10 to 20 MINE CARS — END DUMP. 45 Cubic Foot Capacity — 36 inch Gauge. **Write box 896, Care of Rock Products, 205 W. Wacker Drive, Chicago, Ill.**

Concrete Products Equipment For Sale

FOR SALE

Quinn Pipe Machine with Tongue and Groove forms from 15" to 54", Bell and Spigot forms in 30" and 36" only.

Also Besser face-down mold box block machine, power tamper, with pallets complete.

Reason for Selling: Installing machines of a larger capacity.

Will furnish detailed information and prices upon request.

UNION CONCRETE PIPE COMPANY
Ceredo, W. Va.

MUST SELL IMMEDIATELY

Installing Besser Vibrapac for increased production and must have space.

Used concrete block machinery for sale, now in operation.

Stearns Power Machine
Anchor 8 Bar Tamper
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(Both with vibrator and complete set of attachments.)

4", 5", 8", 10" and 12" steel, cast iron, and aluminum pallets, 40%, 45% and 50% air space.

Also electric truck, conveyor, vibrating table, pallet oilers, bucket drags and stokers.

PYRAMID BLOCK COMPANY
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Business Opportunities

41 acres of Silica Sand near Altoona, Pennsylvania. Runs 99.10% in Silica. Can be scooped up with steam shovel. Partly equipped. Water near and track in off P.R.R. Will sell or lease.

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PHOSPHATE LANDS
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BEST AND SAFEST PLACE TO INVEST IDLE MONEY
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By using Diamond Core Drills. We drill for Limestone, Gypsum, Talc, Fire Clay, Coal and all other minerals.
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Designers of GRAVEL PLANTS for 30 years
SMALL PLANTS to meet local conditions with flexibility, ample crushing, minimum labor, low first cost and maintenance.
LARGE MODERN PLANTS for metropolitan areas.
GROUND STORAGE Plants.
OLD PLANTS modernized.
CONSULTATION REPORTS

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POSITION WANTED

Cement Plant Executive — Age 35 — With twenty years' experience as Chemist, Superintendent and Manager, and thoroughly acquainted with Portland, special and masonry cement manufacture, desires position with progressive concern. Reply to **Box 894, Rock Products, 205 W. Wacker Drive, Chicago, Illinois.**

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DRAFTSMAN EXPERIENCED IN DEsigning crushing and metallurgical machinery. State qualifications and salary expected. Replies will be held in strictest confidence. Address Box 891, Care of Rock Products, 205 West Wacker Drive, Chicago, Illinois.

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We are in the market for and would like to receive prices and literature on the items checked below:

....Admixtures
....Aerial Tramways
....Aggregates (Special)
....Agitators
....Air Compressors
....Air Separators
....Architectural Trimstone Molds
....Ash Receptacle Molds
....Ash & Refuse Handling Equipment
....Asphalt Mixing Plants
....Backdiggers
....Backfillers
....Bags
....Bagging Machines
....Balls (Grinding)
....Barges
....Batchers (Weighing)
....Bearings
....Belting (Conveyor & Elevator)
....Bins (Storage)
....Blasting Supplies
....Block Machines, Building
....Boats
....Brick Machines & Molds
....Buckets
....Building Tile Machines
....Bulk Cement Batching Plants
....Bulk Cement Storage Plants
....Bulldozers
....Bullscrapers
....Burial Vault Forms
....Calcining Equipment
....Calcium Chloride
....Cars (Industrial)
....Catch Basin Block Machines
....Cement Plants
....Cement Colors
....Cement Process
....Central Mixing Plants (Concrete)
....Chimney Block Machines & Molds
....Clarifiers
....Classifiers
....Coal Pulverizing Equipment
....Concentrators
....Concrete Mixers
....Concrete Paints & Coatings
....Concrete Waterproofing & Dampproofing
....Conveyors
....Conveyor Idlers and Rolls
....Coolers
....Corn Crib Block and Tile Machines
....Correcting Basins
....Cranes (Crawler & Locomotive)
....Crushers
....Crushing & Screening Plants (Portable)
....Culvert Pipe Machines & Molds (Concrete)
....Curing Equipment
....Curb Forms (Concrete)
....Dedusters
....Dehydrators
Derricks
....Dewatering Equipment
....Dippers & Teeth
....Disintegrators
....Dragline Cableway Excavators
....Drain Tile Machines
....Dredges
....Dredge Pumps
....Drills (Rock)
....Drill Bits
....Drill Sharpening Machines
....Drill Steel
....Dryers
....Dust Collecting Systems
....Dust Precipitators
....Dust Recovery Plants
....Dynamite
....Electric Motors
....Electrostatic Separators
....Elevators
....Engineering Service (Consulting & Designing)
....Engines (Diesel, Gasoline, Steam)
....Feeders
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....Floor Tile Machines (Concrete)
....Garbage Receptacle Molds (Concrete)
....Garden Furniture Molds (Concrete)
....Generators & Motor Generator Sets
....Greenhouse Bench Forms (Concrete)
....Guns (Hydraulic)
....Gutter Block Machines (Concrete)
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....Hoppers
....Hose
....Hydrators (Lime)
....Joist & Slab Machines (Concrete)
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....Laundry Tub Molds (Concrete)
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....Lime Plants
....Lime Putty Plants
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....Locomotives
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....Pallets (Steel, Wood)
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....Perforated Metal
....Pipe Molds and Machines (Concrete)
....Pipe
....Plaster Mixers
....Pontoons
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....Roofing Tile Machines
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....Sand Lime Brick Machinery
....Sand Settling Tanks
....Scales
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....Screens (Revolving, Vibrating, Etc.)
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....Septic Tank Molds (Concrete)
....Sewer Pipe Machines (Concrete)
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....Shovels (Power)
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....Sill Forms (Concrete)
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....Silo Stave Machines
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....Slurry Mixers
....Slurry Pumps
....Slurry Separators
....Slurry Thickeners
....Step Forms (Concrete)
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....Tanks (Storage)
....Tractors
....Trucks (Agitator)
....Trucks (Dump)
....Trucks (Industrial)
....Trucks (Mixer Body)
....Unloaders
....Unloaders (Boat)
....Unloaders (Box Car)
....Wagons (Dump)
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Index to Advertisers

KOEHRING

Protect Your Shovel

—with the exclusive Koehring Shock Absorber at the foot of the boom. All side thrusts and sudden side dipper impacts are absorbed by the heavy springs within the shock absorbing unit. Not only the boom and dipper sticks, but the whole machine is protected from operating shocks. This exclusive Koehring feature adds materially to the service life of Koehring Shovels.

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The gudgeon journal is cast integral with boom foot. Rotation of the machined gudgeon within the journal is cushioned by the gudgeon lugs compressing the housed springs.

HEAVY-DUTY CONSTRUCTION EQUIPMENT

new
BUCYRUS-MONIGHAN
9-W
WALKING
DRAGLINE
Owned by J. A. Terteling & Sons and operating near Gothenburg, Nebraska, this New Bucyrus-Monighan 9-W uses a 160-foot boom.
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